Waters 3100 Detector

Operator's Guide

71500135102/Revision B

Waters

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Telephone	From the USA or Canada, phone 800 252-HPLC, or fax 508 872-1990. For other locations worldwide, phone and fax numbers appear in the Waters Web site.
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Safety considerations

Some reagents and samples used with Waters instruments and devices can pose chemical, biological, and radiological hazards. You must know the potentially hazardous effects of all substances you work with. Always follow Good Laboratory Practice, and consult your organization's safety representative for guidance.

When you develop methods, follow the "Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory," *American Journal of Medical Technology*, 44, 1, pages 30–37 (1978). This protocol addresses good operating procedures and the techniques necessary to validate system and method performance.

Considerations specific to the 3100 detector

Solvent leakage hazard

The source exhaust system is designed to be robust and leak-tight. Waters recommends you perform a hazard analysis, assuming a maximum leak into the laboratory atmosphere of 10% LC eluate.

Warning:

- To confirm the integrity of the source exhaust system, renew the source O-rings at intervals not exceeding one year.
- To avoid chemical degradation of the source O-rings, which can withstand exposure only to certain solvents (see "Solvents used to prepare mobile phases" on page C-3), determine whether any solvents you use that are not listed are chemically compatible with the composition of the O-rings.

Flammable solvents hazard

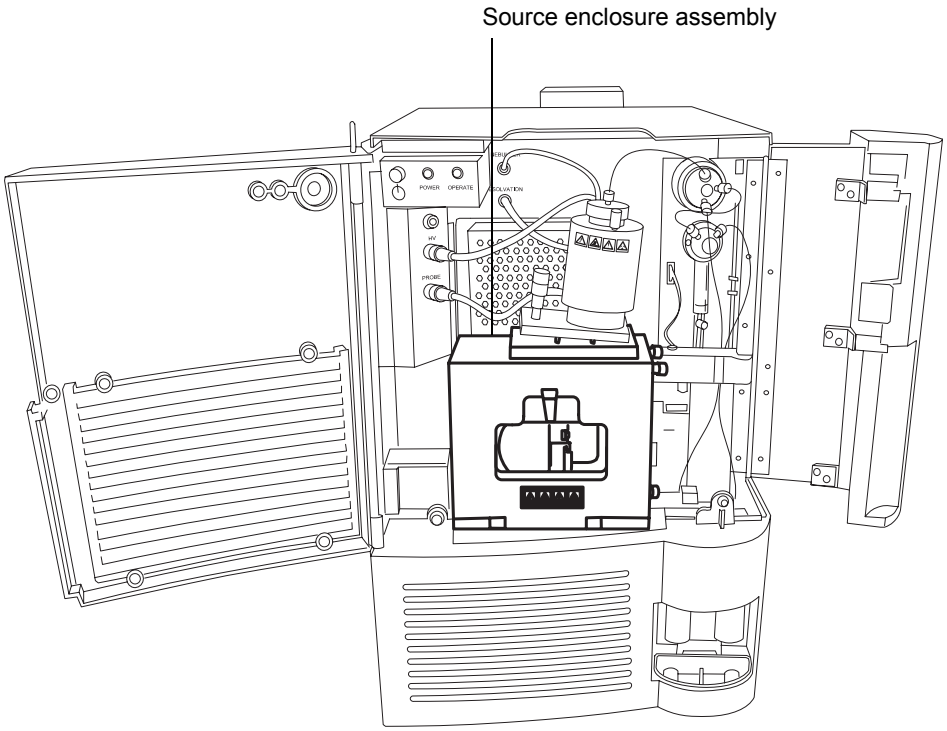
Warning: To prevent the ignition of accumulated solvent vapors inside the source, maintain a continuous flow of nitrogen through the source whenever significant amounts of flammable solvents are used during the instrument's operation.

Never let the nitrogen supply pressure fall below 690 kPa (6.9 bar, 100 psi) during analyses that require flammable solvents. Connect to the LC output with a gas-fail connector to stop the LC solvent if the nitrogen supply fails.

High temperature hazard

Warning: To avoid burn injuries, avoid touching the source enclosure with your hand when operating or servicing the instrument.

3100 detector high temperature hazard



High voltage hazard

Warning:

- To avoid electric shock, do not remove the 3100 detector's protective panels. The components they cover are not user-serviceable.
- To avoid non-lethal electric shock, any equipment connected to the ESI and IonSABRE™ APCI probes must be grounded.
- To avoid nonlethal electric shock when the instrument is in Operate mode, avoid touching the areas marked with the high voltage warning symbol. To touch those areas, first put the instrument in Standby mode.

Safety advisories

Consult Appendix A for a comprehensive list of warning and caution advisories.

Operating this instrument

When operating this instrument, follow standard quality control procedures and the guidelines presented in this section.

Symbols

Symbol	Definition
	Authorized representative of the European Community
	Confirms that a manufactured product complies with all applicable European Community directives.
	For in vitro diagnostic use

Intended use

Waters designed the Single Quad (3100) Detector for use as a research tool to deliver authenticated mass measurement in MS mode.

The Waters 3100 Detector can be used for general in vitro diagnostic applications. However, only professionally trained and qualified laboratory personnel can use the instrument for those purposes.

The Waters 3100 Detector is CE-marked according to the European Union In Vitro Diagnostic Device Directive 98/79/EC.

Calibrating

To calibrate LC systems, follow acceptable calibration methods using at least five standards to generate a standard curve. The concentration range for standards must cover the entire range of quality-control samples, typical specimens, and atypical specimens.

To calibrate mass spectrometers, consult the calibration section of the operator's guide for the instrument you are calibrating.

Quality control

Routinely run three quality-control samples that represent subnormal, normal, and above-normal levels of a compound. Ensure that quality-control sample results fall within an acceptable range, and evaluate precision from day to day and run to run. Data collected when quality control samples are out of range might not be valid. Do not report these data until you are certain that the instrument performs satisfactorily.

When analyzing samples from a complex matrix such as soil, tissue, serum/plasma, whole blood, and so on, note that the matrix components can adversely affect LC/MS results, enhancing or suppressing ionization. To minimize these matrix effects, Waters recommends you adopt the following measures:

- Prior to the instrumental analysis, use appropriate sample pretreatment such as protein precipitation, liquid/liquid extraction (LLE), or solid phase extraction (SPE) to remove matrix interferences.
- Whenever possible, verify method accuracy and precision using matrix-matched calibrators and QC samples.
- Use one or more internal standard compounds, preferably isotopically labeled analytes.

IVD authorized representative information

IVD authorized representative

Waters Corporation (Micromass UK Limited) is registered in the United Kingdom with the Medicines and Healthcare Products Regulatory Agency (MHRA) at Market Towers, 1 Nine Elms Lane, London, SW8 5NQ. The reference number is IVD000167.

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Table of Contents

1 Waters 3100 Detector Overview

This chapter describes the instrument, including its controls and gas and plumbing connections.

Contents

Overview

Waters 3100 Detector

The Waters® 3100 Detector is a single-quadrupole, atmospheric pressure ionization (API) mass spectrometer. Designed for routine UPLC®/MS analyses, it can scan at speeds up to 10,000 Da/s.

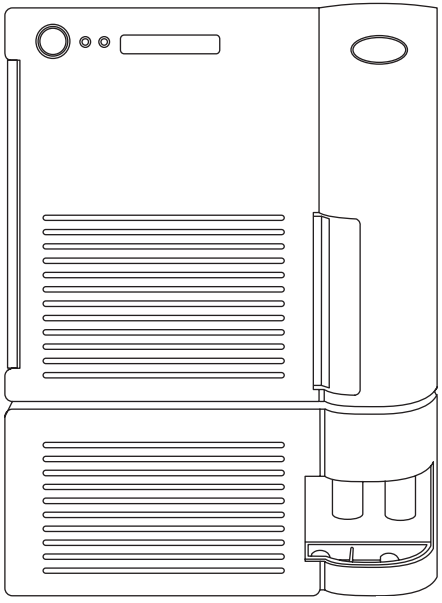
Waters provides these ion sources with the instrument as standard equipment:

- ZSpray™ (dual orthogonal sampling) interface.
- Multi-mode ESCi® ionization switching for atmospheric pressure chemical ionization (APCI) and electrospray ionization (ESI).

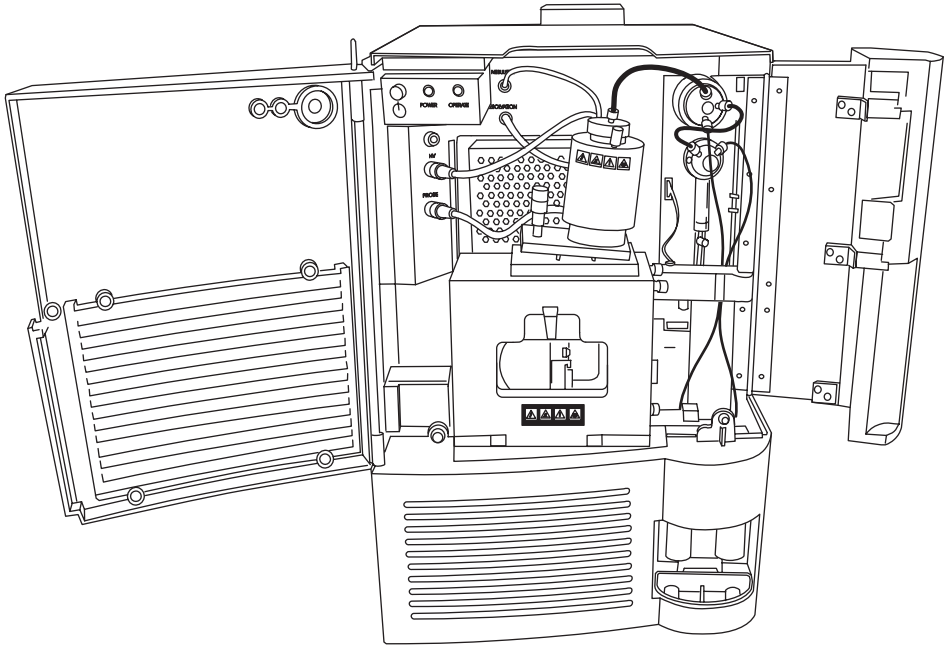
Optional ionization modes are IonSABRE™ APCI and APPI (atmospheric pressure photoionization).

For detector specifications, see the *Waters 3100 Detector Site Preparation Guide*.

Waters 3100 Detector



Waters 3100 Detector with doors open



IntelliStart technology

IntelliStart™ technology monitors LC/MS performance and reports when the detector is ready for use.

The IntelliStart software automatically tunes and mass calibrates the detector and displays performance readbacks. Integrated with Empower™ chromatography or MassLynx™ mass spectrometry software, IntelliStart enables simplified setup of the system for use in routine analytical and open access applications. (See “Software and data system” on page 1-4).

The IntelliStart fluidics system is built into the detector. It delivers sample directly to the MS probe from the LC column or from two integral reservoirs. The integral reservoirs can also deliver sample through direct or combined infusion so that you can optimize instrument performance at analytical flow rates. See the detector’s online Help for further details of IntelliStart.

Software and data system

The detector is controlled by either Empower chromatography software or MassLynx mass spectrometry software. Each is a high-performance application that acquires, analyzes, manages, and distributes ultraviolet (UV), evaporative light scattering, analog, and mass spectrometry data.

Both Empower and MassLynx software enable these major operations:

- Configuring the instrument.
- Creating LC and MS methods that define operating parameters for a run.
- Using IntelliStart software to tune and mass calibrate the detector.
- Running samples.
- Monitoring the run.
- Acquiring data.
- Processing data.
- Reviewing data.
- Printing data.

See Empower and MassLynx 4.1 user documentation and online Help for more information on installing and using Empower or MassLynx software.

Ionization techniques and source probes

Electrospray ionization (ESI)

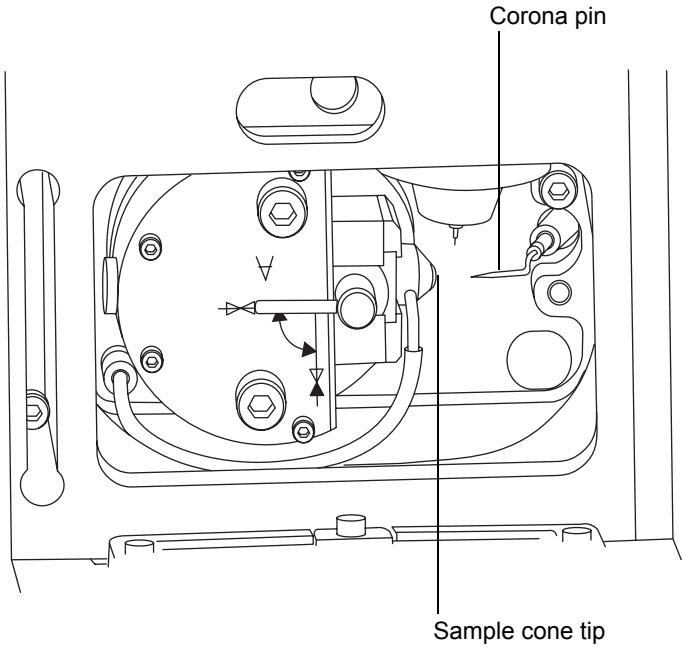
In electrospray ionization (ESI), a strong electrical charge is given the eluent as it emerges from a nebulizer. The droplets that compose the resultant aerosol undergo a reduction in size (solvent evaporation). As solvent continues to evaporate, the charge density increases until the droplet surfaces eject ions (ion evaporation). The ions can be singly or multiply charged. The multiply charged ions are of particular interest because the detector separates them according to their mass-to-charge ratios (m/z), permitting the detection of high-molecular-weight compounds.

The instrument can accommodate eluent flow rates of up to 1 mL/min.

Combined electrospray ionization and atmospheric pressure chemical ionization (ESCi)

Combined electrospray ionization and atmospheric pressure chemical ionization (ESCi) is supplied as standard equipment on the detector. In ESCi, the standard ESI probe is used in conjunction with a corona pin to allow alternating acquisition of ESI and APCI ionization data, facilitating high throughput and wider compound coverage. See “Electrospray ionization (ESI)” on page 1-4.

ESCi mode



Atmospheric pressure chemical ionization

A dedicated high performance atmospheric pressure chemical ionization (APCI) probe is offered as an option. See Chapter 6, “Optional APCI Mode of Operation”, for full details.

Atmospheric pressure photoionization

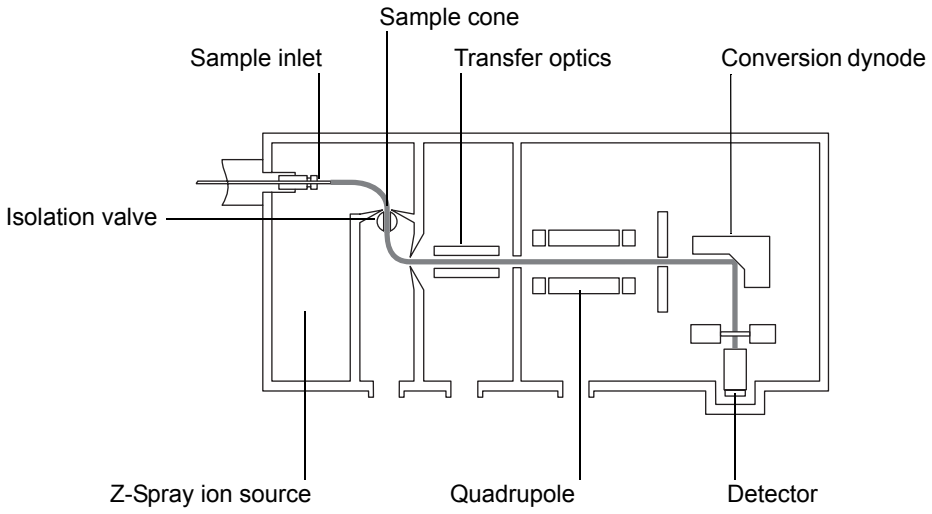
Atmospheric pressure photoionization (APPI) is offered as an option. It uses photons generated by a krypton-discharge ultraviolet (UV) lamp (~10.2 eV) to produce sample ions from vaporized LC eluent.

Ion optics

The detector's ion optics operate as follows:

1. Samples from the LC or Intellistart fluidics system are introduced at atmospheric pressure into the ionization source.
2. The ions pass through the sample cone into the vacuum system.
3. Ions are filtered according to their mass-to-charge ratio (m/z).
4. The transmitted ions are detected by the photomultiplier detection system.
5. The signal is amplified, digitized, and sent to the Empower chromatography or MassLynx mass spectrometry software.

Ion optics overview



MS operating modes

The detector has two modes of operation:

- Scanning, where the detector is scanned to separate the ions in the ion beam according to their mass-to-charge (m/z) ratio and hence produce a mass spectrum.
- Selected Ion Recording (SIR), where the detector is tuned to detect an ion, or ions, with specific m/z ratios.

Sample inlet

Either of two methods delivers solvent and sample to the installed probe:

- An LC system, which delivers the eluent from an LC analysis.
- IntelliStart fluidics system, which uses onboard solutions to automate instrument optimization. You can deliver solutions by direct or combined infusion.

Vacuum system

An external roughing (rotary vane) pump and an internal split-flow turbomolecular pump combine to create the source vacuum. The turbomolecular pump evacuates the analyzer and ion transfer region.

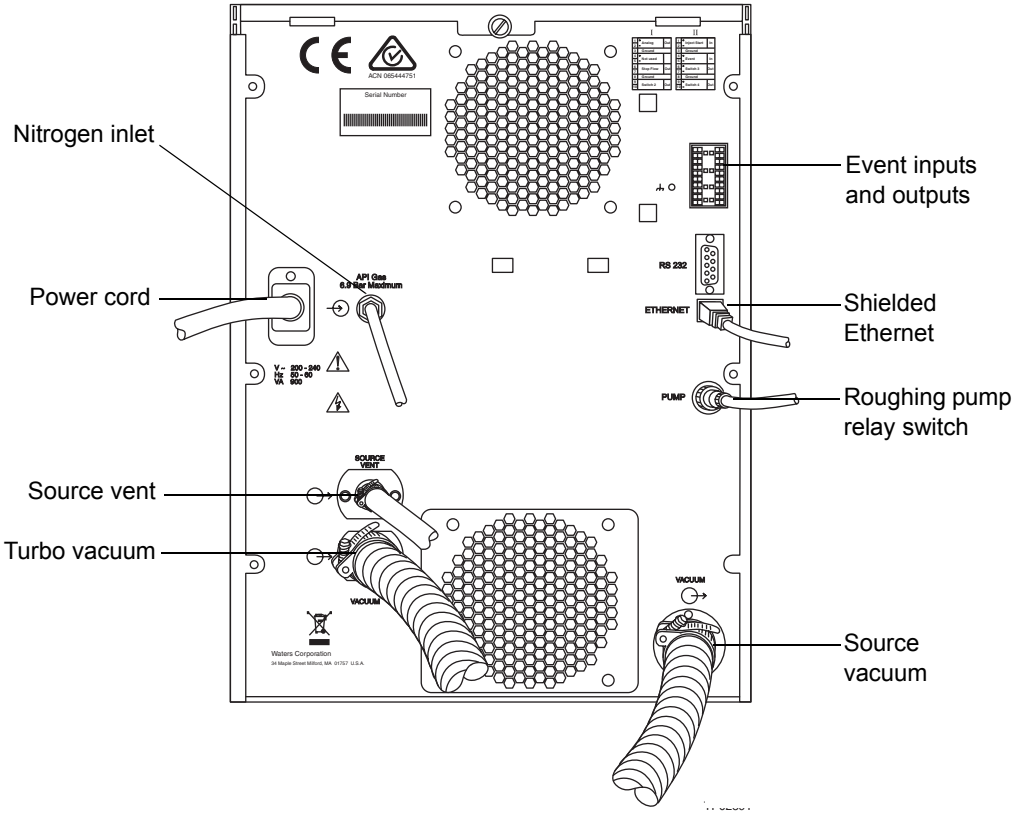
Vacuum leaks and electrical or vacuum pump failures cause vacuum loss, which protective interlocks guard against. The system monitors turbomolecular pump speed and continuously measures vacuum pressure with a built-in Pirani gauge. The gauge also serves as a switch, stopping operation when it senses vacuum loss.

A vacuum isolation valve isolates the source from the mass analyzer, allowing routine source maintenance without venting.

Rear panel

The following figure shows the rear panel locations of the connectors used to operate the detector with external devices.

Detector rear panel



IntelliStart fluidics system overview

The IntelliStart fluidics system is built into the detector. The system delivers sample directly to the MS probe in one of two ways:

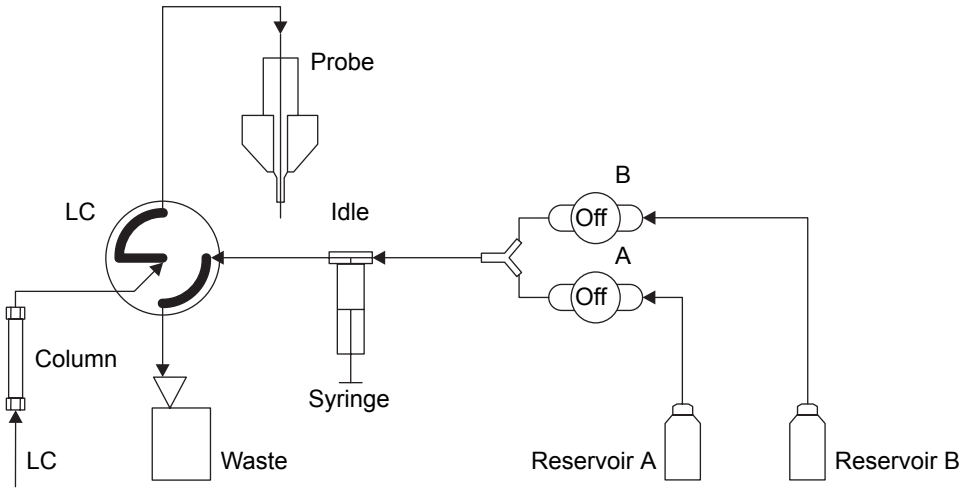
- From the LC column.
- From two integral reservoirs.

  Tip: The integral reservoirs can also deliver sample through direct or combined infusion to enable optimization at analytical flow rates.

The IntelliStart system incorporates a multi-position valve with these attributes:

- An input connection from an external LC column.
- An input connection from the detector's infusion syringe. (The detector's infusion syringe is also connected to two reservoirs, A and B. In the software, you specify which reservoir to draw from.)
- An output connection to the detector's probe.
- An output connection to a waste line.

Fluidics system



IntelliStart fluidics system operation

Control of solvent and sample delivery during auto-tuning, auto-calibration, and method development is automatically performed by the software.

IntelliStart configuration requirements can be set in the system console. You can edit the parameters, frequency, and extent of the automation you want IntelliStart to perform. See the detector's online Help for further details of IntelliStart.

Operating the IntelliStart fluidics system

To enable the fluidics system controls (Empower only)

In the console system tree, expand 3100 Detector.

To set the infusion flow rate

In the console window, click the current flow rate.

To select the reservoir

In the console window, click the highlighted reservoir bottle text—A or B.

To select the flow state

In the console window, click the diverter valve position label.

To start the infusion syringe flow

In the console window, click  . A status bar indicates the amount of fluid in the syringe and the amount of time remaining before the fluid empties. When the syringe is empty the system becomes idle.

To refill the infusion syringe

In the console window, click  .

To purge the infusion syringe

In the console window, click  . For further details, see "Purging the infusion syringe" on page 2-11.

To stop the current action

In the console window, click  .

To disable the fluidics system controls (Empower only)

In the console window, click Control  .

Operating the IntelliStart fluidics system from the Tune window

To operate the IntelliStart fluidics system from the Tune window

1. In the Console system tree, click 3100 Detector.
2. Click Tune  .
3. In the 3100 Detector Tune window, click the Fluidics tab.
4. Set the Flow Control parameters according to the instructions in the Empower or MassLynx online Help.

Programming the MS instrument method to operate the IntelliStart fluidics system

In the MS instrument method, you can program the operation of the system's multi-position valve to infuse sample during a run. The valve can also divert LC flow to waste as a timed event.

To program the MS instrument method using MassLynx software

1. In the MassLynx window, click MS Method.
2. In the MS Methods window, click Options > Method Events.

3. In the Method events dialog box, select the desired flow state, as indicated by the following table.

Flow states and results

Flow state setting	LC flows to	Syringe flows to
LC	3100 probe	Waste
Combined	3100 probe	3100 probe
Infusion	Waste	3100 Probe
Waste	Waste	Waste
No change	No change	No change

Tip: At the time you power-on the instrument, the LC state is “waste”.

For further instruction, see the MassLynx online Help topic “Advanced Methods and Events”.

To program the MS instrument method using Empower software

1. In the Empower Pro interface click Run Samples, select your system, and then click OK.
2. In the Run Samples window, click Edit > Instrument Method.
3. In the instrument method editor, click the button representing your MS detector.
4. Click Events.

5. On the Events tab, select the desired flow path, as indicated by the following table.

Flow paths and results

Flow path setting	LC flows to	Syringe flows to
LC	3100 probe	Waste
Combined	3100 probe	3100 probe
Infusion	Waste	3100 Probe
Waste	Waste	Waste
No change	No change	No change

Tip: At the time you power-on the instrument, the LC state is “waste”.

For further instruction, see the Empower online Help topic “Configuring events”.

2 Preparing the Detector for Operation

This chapter describes how to start and shut-down the detector.

Contents

Starting the detector

Caution: Using incompatible solvents can cause severe damage to the instrument. Refer to Appendix C, "Materials of Construction and Compliant Solvents", for 3100 detector solvent information.

Starting the detector entails powering-on the workstation, logging into the workstation, powering-on the detector and all the other instruments, and starting the Empower or MassLynx software.

Requirement: You must power-on and log in to the workstation first to ensure that it obtains the IP addresses of the system instruments.

To start the detector

Warning: During analyses that require flammable solvents, to avoid ignition of the solvents, never let the nitrogen supply pressure fall below 690 kPa (6.9 bar, 100 psi).

1. Ensure the nitrogen supply is connected to the instrument's API gas connection.

   Requirement: The nitrogen must be dry and oil-free, with a purity of at least 95%. Regulate the supply at 600 to 690 kPa (6.0 to 6.9 bar, 90 to 100 psi).

   For more information on connections, see the figure "Detector rear panel" on page 1-8.

2. Power-on the HPLC system workstation, and log in before powering-on the other instruments.

3. Press the power switch on the top, left-hand side of the detector and HPLC instruments. Each system instrument "beeps" and runs a series of startup tests.

4. Allow 3 minutes for the embedded PC to initialize. An audible alert sounds when the PC is ready.

   The power and status LEDs change as follows:

   - Each system instrument's power LED shows green.

- During initialization, the binary solvent manager's and sample manager's status LED flashes green.
- After the instruments are successfully powered-on, all power LEDs show steady green. The binary solvent manager's flow LED, the sample manager's run LED, and the detector's Operate LED remain off.

5. Start Empower or MassLynx software. You can monitor the console for messages and LED indications.
6. Launch IntelliStart using one of the following methods.
   - MassLynx – In the MassLynx main window's lower left-hand corner, click IntelliStart.
   - Empower – In the Run Samples window, right-click the detector's control panel, and then click Launch Intellistart.

   Result: The detector's console appears. The detector is in Standby mode.
7. Click Control > Pump to start the roughing pump. The Operate LED remains off.

   Tip: There is a 20-second delay, during which the turbopump is starting, before the roughing pump starts. IntelliStart displays "Instrument in standby".
8. Click Resolve  or Operate  to put the detector into Operate mode. When the detector is in good operating condition, IntelliStart displays "Ready".

   Tip: Clicking Resolve  prepares the system for operation, putting the detector into Operate mode. If clicking Resolve fails to put the instrument into Operate mode, IntelliStart displays corrective actions.

Configuring IntelliStart

To configure IntelliStart

1. In the console system tree, expand 3100 Detector.
2. Click IntelliStart.
3. Click Configure > IntelliStart Configuration.
4. In the IntelliStart Configuration dialog box, in the Checks list, select the check boxes for the items you want checked during 3100 detector startup. Clear the check boxes of items you do not want checked.

   Tip: To display detailed information for an item, highlight it and then click Properties.
5. Click OK.

Verifying the instrument's state of readiness

When the detector is in good operating condition, the power and Operate LEDs show constant green. You can view any error messages in IntelliStart.

To access IntelliStart

1. In the console system tree, expand 3100 Detector.
2. Click IntelliStart.

Tuning and calibration information

The detector must be tuned and calibrated prior to use, tasks normally performed from IntelliStart.

For further instruction, see the detector's online Help topic "Instrument Setup" and Chapter 4, "Operating the Detector".

Monitoring the detector LEDs

Light-emitting diodes on the detector indicate its operational status.

Power LED

The power LED, to the top, left-hand side of the detector's front panel, indicates when the detector is powered-on or powered-off.

Operate LED

The Operate LED, on the right-hand side of the power LED, indicates the operating condition.

See the detector's online Help topic "Monitoring the detector LEDs" for details of the Operate LED indications.

For additional information, see “Connecting the liquid waste line” on page B-23.

Installing the solvent manifold drip tray

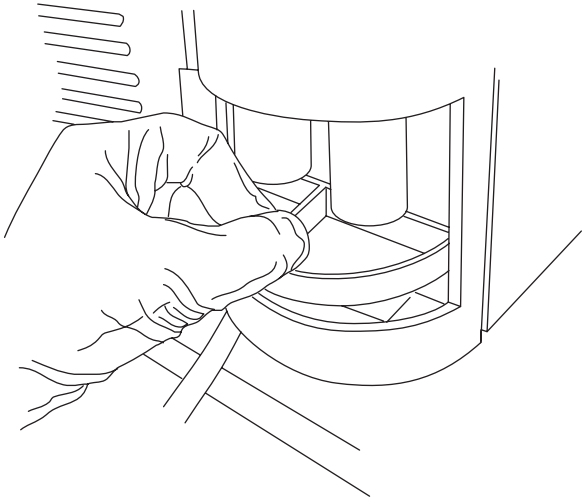
Required material

Chemical-resistant, powder-free gloves

To install the solvent manifold drip tray

Warning: The solvent manifold drip tray can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Install the solvent manifold drip tray as shown below:



Installing the reservoir bottles

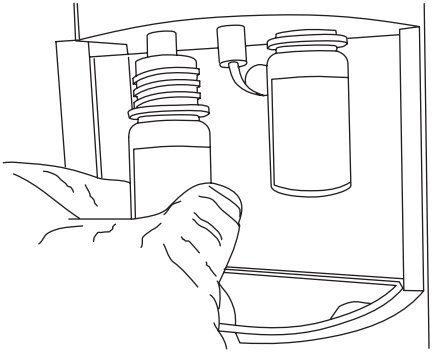
An optional Low-volume Adaptor Kit is available for infusing smaller volumes. The low-volume vials have a volume of 1.5 mL.

Required material: Chemical-resistant, powder-free gloves

To install the reservoir bottles

Warning: The reservoir bottles can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the reservoir bottle caps.
2. Screw the reservoir bottles onto the detector as shown below.

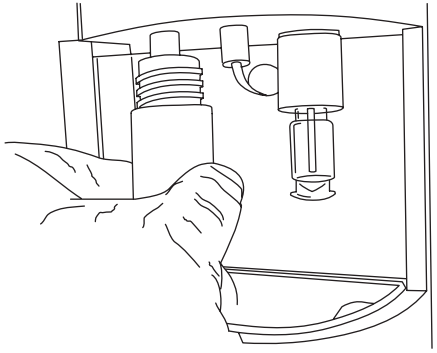


To install low-volume vials

Warning: The reservoir bottles can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. If a standard reservoir bottle is fitted, remove the reservoir bottle.
2. Screw the low-volume adaptor into the manifold and tighten it finger-tight.

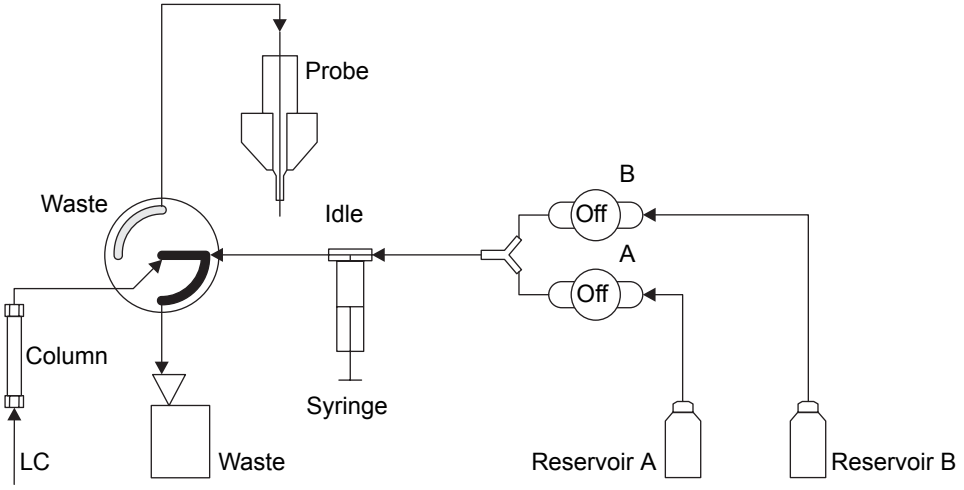
3. Screw the low-volume vial into the adaptor.



Diverter valve positions

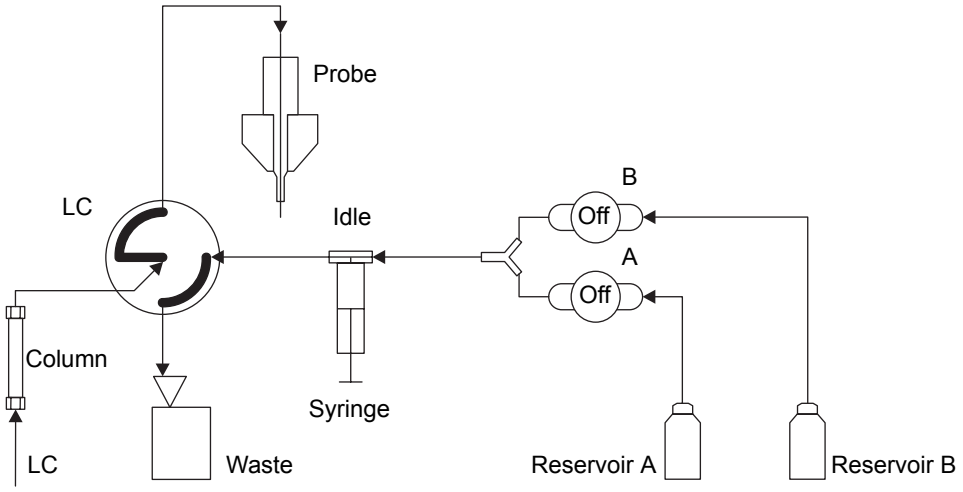
Column and syringe in home position after power-up

After power-up, the flow path between the column and waste is open. The syringe is empty, and the flow path between it and waste is open.

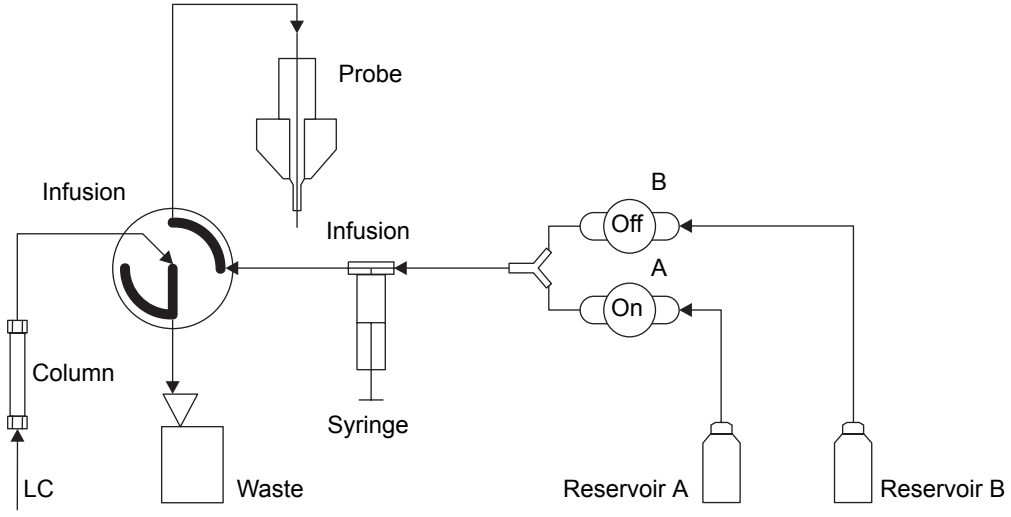


LC position

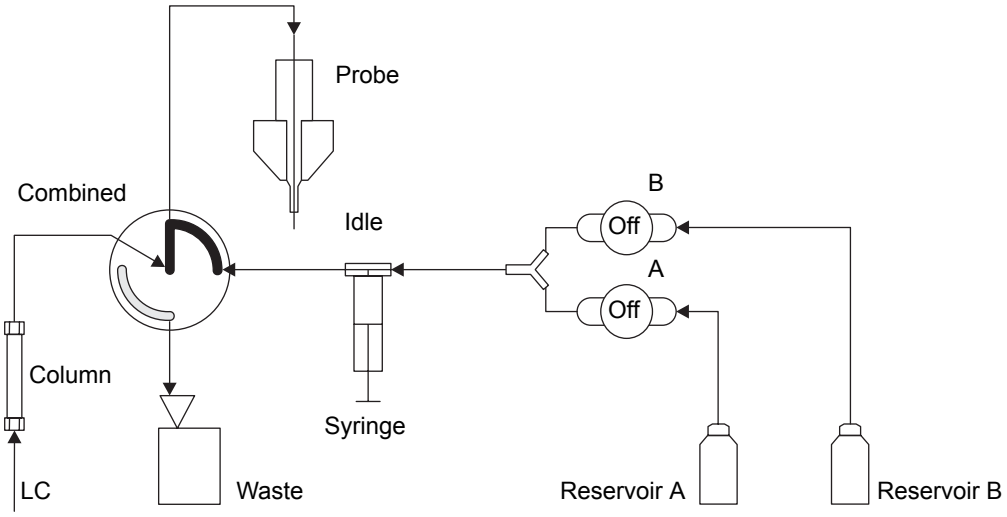
In the LC position, the flow path between the LC and probe is open, and the flow path between the syringe and waste is also open.



Infusion position

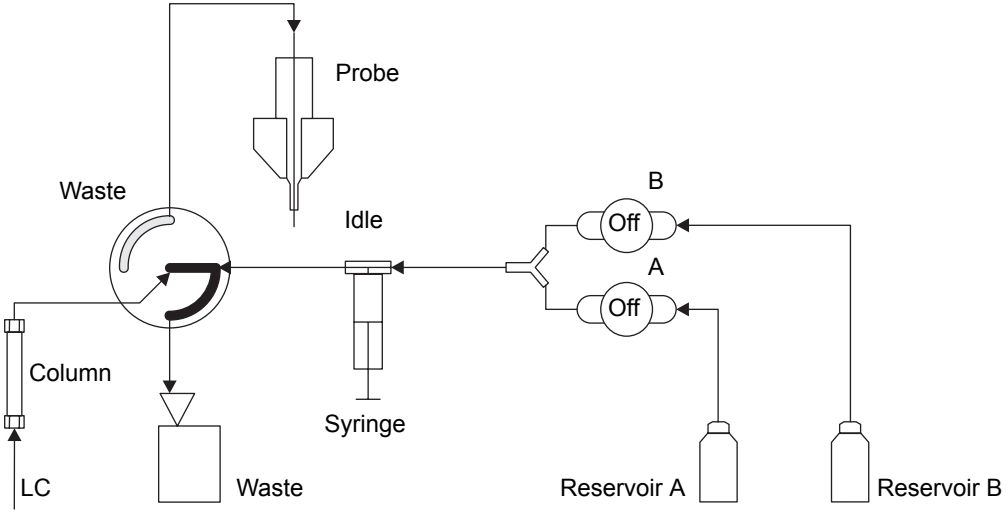


Combined position with LC flow and syringe in idle mode



Waste position

In the waste position, both the LC flow and the infusion syringe flow are directed to waste. The syringe mode can be only static or dispensing (that is, never drawing).



Purging the infusion syringe

Whenever you replace a solution bottle, purge the infusion syringe with the solution that you are going to use next.

Tip: Depending on the solutions used, the IntelliStart fluidics system can require more than one purge cycle to minimize carryover.

To purge the infusion syringe

1. In the console system tree, expand 3100 Detector.
2. If you use MassLynx software, click Interactive Display; otherwise click Interactive Fluidics.
3. If you use Empower software, click Control  .
4. Select the required solution reservoir.
5. Click  to purge the system.

   Tip: System purge takes approximately 2 minutes and uses a total volume of 800 µL.

Rebooting the detector

Reboot the detector when any of these conditions applies

- The Tune window fails to respond.
- Empower or MassLynx software fails to initialize.
- Immediately following a software upgrade.

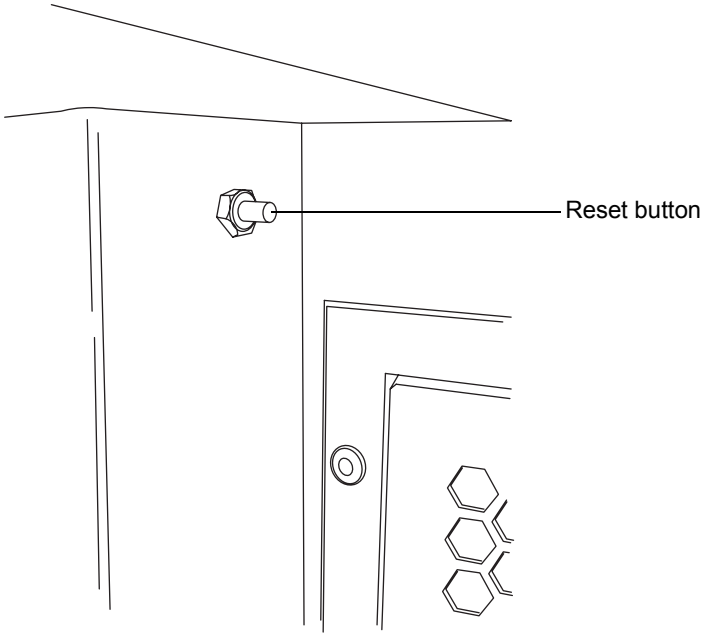
Rebooting the detector by pressing the reset button

The reset button shuts down the electronics momentarily and causes the detector to reboot.

To reboot the detector by pressing the reset button

1. Open the detector's front, left-hand door.

2. Press the red reset button on the top, left-hand side of the instrument.



Shutting down the detector

Recommendation: Leave the detector in Operate mode except when performing routine maintenance.

If you must shut down the detector, refer to the instructions in this section.

Caution: Buffers left in the system can precipitate and damage instrument components.

Tip: Set system shutdown parameters in the shutdown editor. Consult the MassLynx online Help for more information.

Putting the detector in Standby mode for overnight shutdown

To put the detector in Standby mode overnight

1. Ensure that there is sufficient capacity in the waste container for the LC flow that is to be diverted to waste. See "Connecting the liquid waste line" on page B-23.

2. In the console, click  to stop the LC flow or, if column flow is required, divert the LC flow to waste as follows:

   a. In the console system tree, expand 3100 Detector.

   b. If you use MassLynx software, click Interactive Display; otherwise click Interactive Fluidics.

   c. If you use Empower software, click Control  .

   d. Click the current diverter valve position label.

   e. In the Select a Flow State dialog box, select Waste.

   f. Click OK.

3. Click Standby  to shut off heaters and voltages.

   Tip: You can create a method to stop the gas flow or lower the temperature. See the Empower or MassLynx online Help for more information on creating methods.

Complete detector shutdown

To completely shut down the detector

1. Put the detector in Standby mode. See "Putting the detector in Standby mode for overnight shutdown" on page 2-13.

2. In the console, click API  .

3. Click Control > Vent.

   Result: The turbomolecular pump is switched off. When the turbomolecular pump runs down to half its normal operating speed, the vent valve opens and the instrument is automatically vented. The Operate LED changes from green to red and then turns off.

4. Exit MassLynx or Empower software.
5. After the roughing pump shuts off, operate the power button (on the front of the instrument) to power-off the detector.

   Warning: The 3100 detector's power switch does not isolate the instrument from the main power supply. To isolate the instrument, you must disconnect the power cable from the back of the instrument.

6. Disconnect the power cable from the back of the detector.
7. Power-off all other instruments and the workstation.

   Note: The fans inside some instruments run continuously, even after you power-off the instruments.

Emergency detector shutdown

To shut down the detector in an emergency

Warning: The 3100 detector's power switch does not isolate the instrument from the main power supply. To isolate the instrument, you must disconnect the power cable from the back of the instrument.

Caution: Data can be lost during an emergency shutdown.

1. Operate the power button on the front of the detector.
2. Disconnect the power cable from the back of the detector.

3 ESI and ESCi Modes of Operation

This chapter describes how to prepare the detector for the following modes of operation:

- ESI (electrospray ionization).
- ESCi (combined electrospay and atmospheric pressure chemical ionization).

If your system uses APCI mode, see Chapter 6, "Optional APCI Mode of Operation".

Contents

Introduction

The ESI and ESCi ionization mode options use the standard ESI probe that is fitted to the instrument when it is shipped from the factory. For ESCi operation, the corona pin is used in conjunction with the ESI probe. The following sections explain how to install and remove the ESI probe and corona pin.

For further instruction, see "Electrospray ionization (ESI)" on page 1-4. and "Combined electrospray ionization and atmospheric pressure chemical ionization (ESCi)" on page 1-5.

Installing the ESI probe

Required material: Chemical-resistant, powder-free gloves

To install the ESI probe

Warning: The HPLC system connections, ESI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

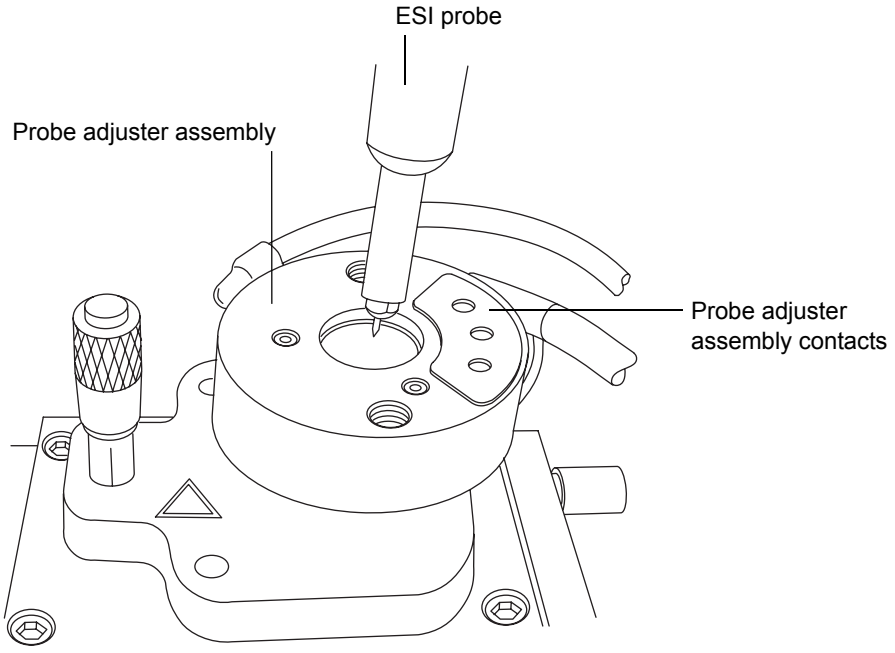
2. Open the instrument's access door.

   Warning: The ESI probe tip is sharp. To avoid puncture wounds, handle the ESI probe with care.

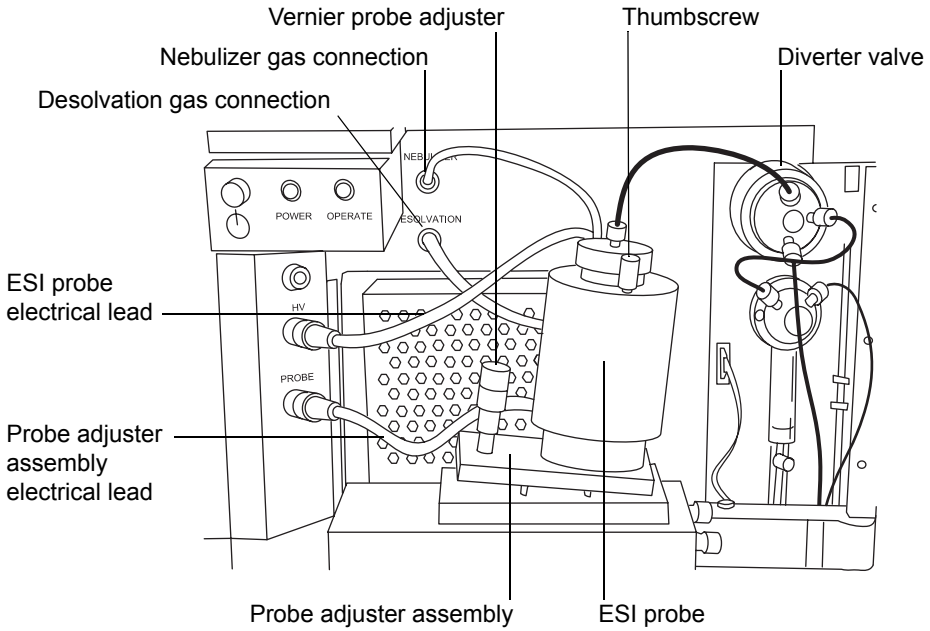
3. Remove the protective sleeve, if fitted, from the ESI probe tip.

4. Ensure that the contacts on the ESI probe align with the probe adjuster assembly contacts, and carefully slide the ESI probe into the hole in the probe adjuster assembly.



5. Secure the ESI probe by tightening the 2 thumbscrews.

ESI probe mounted on the source enclosure, showing the connections to the front panel



6. Connect the ESI probe's PTFE tube to the nebulizer gas connection.
7. Ensure that the probe adjuster assembly's electrical lead is connected to the instrument's probe connection.
8. Connect the ESI probe's electrical lead to the instrument's HV connection.

Warning: To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the ESI probe; use the PEEK™ tubing supplied with the instrument.

9. Using tubing greater than or equal to 0.004-inch (ID), connect the diverter valve to the ESI probe.

   Tip: Two tubes of different ID are supplied with the instrument.

   Requirement: If you are replacing the tubing supplied with the instrument, you must minimize the length of the tube connecting the diverter valve to the ESI probe. Doing so minimizes delays and dispersion.

10. Close the instrument's access door.

Installing the corona pin

Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers

To install the corona pin

Warning: The HPLC system connections, ESI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is in Standby mode when commencing this procedure.

1. In the console, click Standby  , and confirm that the Operate indicator is not illuminated.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

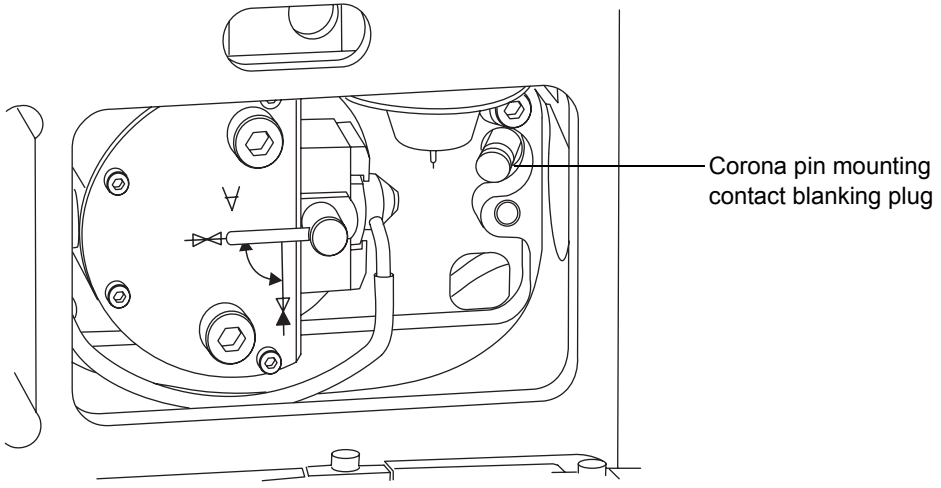
2. Open the instrument's access door.

Warning: The probe tip is sharp. To avoid puncture wounds, take great care while working with the source enclosure door open if an ESI probe is fitted.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unlatch the source enclosure door's handle by pulling it upward to the horizontal position and then rotating it 90 degrees clockwise, and then open the door.
4. Use the needle-nose pliers to remove the blanking plug from the corona pin mounting contact. Store the blanking plug in a safe location.

Corona pin mounting contact



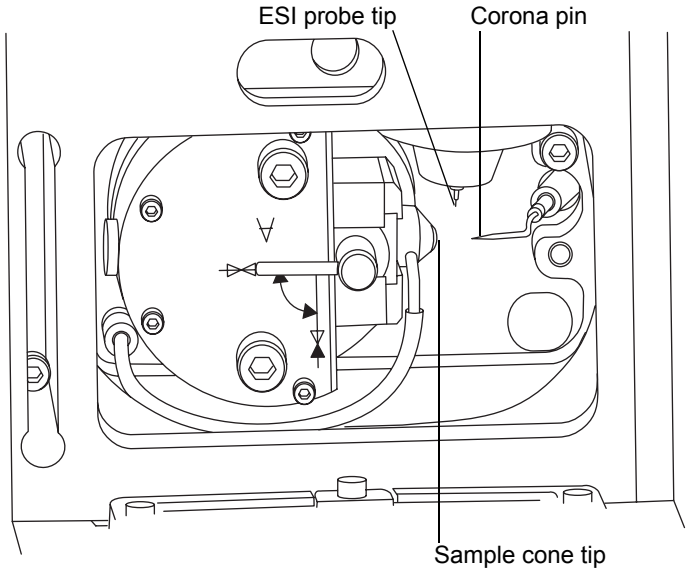
Warning: The corona pin tip is sharp. To avoid puncture wounds, handle the corona pin with care.

Caution: To avoid damaging to the corona pin's tip and bending the pin, use the needle-nose pliers to grip the corona pin at the end that fits into the mounting contact.

5. Use the needle-nose pliers to fit the corona pin to the mounting contact.

   Requirement: Ensure that the corona pin is securely mounted and that its tip aligns with the sample cone orifice.

   Corona pin



6. Use the vernier probe adjuster to position the ESI probe tip so that it is pointing approximately midway between the tips of the sample cone and corona pin. (See the figure "ESI probe mounted on the source enclosure, showing the connections to the front panel" on page 3-4.)

7. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.

8. Close the instrument's access door.

Optimizing the ESI probe for ESCi operation

Required material: 80:20 acetonitrile/water

To optimize the ESI probe for ESCi operation

1. In the console, click 3100 Detector, and then click Tune  .
2. In the Tune window, click Setup > Inter-scan Setup.
3. In the Inter-scan Setup dialog box, click Reset to Defaults.
4. Click OK.
5. In the Tune window, click Ion Mode > ESCi+.
6. Select box numbers 1 and 2, clear box numbers 3 and 4 (above the peak display).
7. In row 1, set Ion Mode to ES.
8. In row 2, set Ion Mode to APCI.
9. In each row, set Mass to 42 and Span to 5.
10. Start an infusion of 80:20 acetonitrile/water.
11. Use the vernier probe adjuster to ensure that the ESI probe tip is pointing approximately midway between the tips of the sample cone and corona pin.
12. In the Tune window, observe the 42 Da peak in the ES+ and APCI+ peak displays, and increase the values of Capillary (kV) and Corona [(µA) in the current mode or kV in the voltage mode] to produce the most intense ESI+ and APCI+ signal.
13. Use the vernier probe adjuster to gradually move the probe bi-directionally to determine the best position for both the ESI+ and APCI+ signals.
14. To determine whether you have discrete ionization in the ESI or APCI mode, set the Capillary parameter to 0 kV and observe that little or no

signal remains in ESI mode. Then set the Corona parameter to 0 µA or 0 kV, and observe that little or no signal remains in APCI mode.

Result: The ESI probe is now optimized for ESCi mode.

Tip: If necessary, repeat the above procedure using the analyte of interest, because ionization potentials can vary with different samples.

Removing the corona pin

Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers

To remove the corona pin

Warning: The HPLC system connections, corona pin, ESI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is in Standby mode when commencing this procedure.

1. In the console, click Standby  , and confirm that the Operate indicator is not illuminated.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

2. Open the instrument's access door.

Warning: The probe tip is sharp. To avoid puncture wounds, take great care while working with the source enclosure door open if an ESI probe is fitted.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unlatch the source enclosure door's handle by pulling it upward to the horizontal position and then rotating it 90 degrees clockwise, and then open the door.

Warning: The corona pin tip is sharp. To avoid puncture wounds, handle the corona pin with care.

Caution: To avoid damaging to the corona pin's tip and bending the pin, use the needle-nose pliers to grip the corona pin at the end that fits into the mounting contact.

4. Use the needle-nose pliers to remove the corona pin from its mounting contact. Store the corona pin in a safe location. (See the figure "Corona pin" on page 3-7.)
5. Use the needle-nose pliers to fit the blanking plug to the corona pin mounting contact. (See the figure "Corona pin mounting contact" on page 3-6.)
6. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
7. Close the instrument's access door.

Removing the ESI probe

Required material: Chemical-resistant, powder-free gloves

To remove the ESI probe

Warning: The HPLC system connections, ESI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The ESI probe and source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

2. Open the instrument's access door.
3. Disconnect the diverter valve tubing from the ESI probe.
4. Disconnect the ESI probe's electrical lead from the high voltage connection.
5. Ensure that the API gas is turned off.
6. Disconnect the ESI probe's PTFE tube from the nebulizer gas connection.
7. Undo the 2 thumbscrews securing the ESI probe to the probe adjuster assembly.

   Warning: The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

8. Carefully remove the ESI probe from the probe adjuster assembly.
9. If available, fit the protective sleeve to the ESI probe tip.
10. Close the instrument's access door.

4 Operating the Detector

This chapter is an introduction to operating your detector; it explains these tasks:

- Setting-up your detector.
- Performing a sample tune.
- Developing instrument methods.
- Verifying the system.

Contents

Setting-up the instrument

The IntelliStart instrument setup calibrates the instrument and then, by default, performs a sample tune. If calibration is unnecessary, you can perform only a sample tune. See "Performing a sample tune" on page 4-6.

In the following example, sodium cesium iodide is used as the calibrant solution and sulfadimethoxine is used as the tune sample.

Tips:

- You can substitute solutions suitable for your requirements.
- Instrument setup need only be performed every 3 to 6 months, depending on your usage requirements.

See the detector's online Help for further details of IntelliStart.

Requirement: If you use Empower software, your project must contain the instrument methods supplied during installation of the detector software. See the Empower online Help for further details on restoring projects.

Required materials:

- Sodium cesium iodide solution (2 ng/µL)
- Sulfadimethoxine solution (100 pg/µL)

To prepare the IntelliStart fluidics system

Requirement: Ensure that there is enough solution in each reservoir for approximately 5 minutes of operation after purging the reservoirs.

Recommendation: In general, place calibrant solution in reservoir A and sample solution in reservoir B.

1. Ensure that IntelliStart fluidics system's reservoir A is filled with sodium cesium iodide solution.
2. Ensure that reservoir B is filled with sulfadimethoxine solution.
3. Launch the console using one of the following methods.
   - MassLynx – In the MassLynx main window, click MS Console.
   - Empower – In the Run Samples window, right-click the detector's control panel, and then click Launch Instrument Console.
4. In the console system tree, expand 3100 Detector.

5. If you use MassLynx software, click Interactive Display; otherwise click Interactive Fluidics.
6. If the calibration reservoir is selected, click  to purge the system.

   Tip: System purge takes approximately 2 minutes.
7. If the sample reservoir is selected, click on the reservoir display and in the Select Reservoir dialog box, select the calibration reservoir.
8. Click OK.

   Result: The calibration reservoir is selected, and the system is purged.

To specify the instrument set-up parameters

1. In the console system tree, click 3100 Detector.
2. Ensure that Ion Mode is ES+.
3. Click IntelliStart.
4. Ensure that Instrument Setup is selected.
5. If you require system pre-checking, select Pre-checks.

   Rationale: If Pre-checks is selected, when IntelliStart starts the instrument setup, it determines whether the existing calibration is still valid. If so, it does not perform a full calibration but proceeds to sample tuning the instrument.

   For further details, see the detector's online Help topic "IntelliStart flow diagram".
6. Click Start  to open the IntelliStart Setup Parameters dialog box.
7. In the Instrument Setup tab's Reference list, click Naics.

   Rationale: Naics is the calibration reference for sodium cesium iodide when working in ES+ ion mode.

8. If you use MassLynx software, click “Fill from reference file”; otherwise, click “Get Reference Masses”.

   Result: The default mass values appear in the Instrument Tune Masses text boxes.

   Rule: You must click “Fill from reference file” or “Get Reference Masses” to obtain the masses from the reference each time you select a new calibration reference.

   Tip: You can use alternative reference solutions to calibrate at different masses.

9. The tune and calibration results are saved with the names specified. You can use the default names or enter your own.

To specify the sample tune parameters using MassLynx software

This procedure applies only if you are using MassLynx software. If you are using Empower software, see “To specify the sample tune parameters using Empower software” on page 4-4.

1. In the IntelliStart Setup Parameters dialog box, click the Sample Tune tab.
2. For the first sample tune mass, select the check box and enter a value of 311.
3. Clear all the check boxes for other sample tune masses.
4. In the Tune text box, enter sulfadimethoxine.ipr.

   Rationale: The sample tune results are written to this file.

To specify the sample tune parameters using Empower software

This procedure applies only if you are using Empower software. If you are using MassLynx software, see “To specify the sample tune parameters using MassLynx software” on page 4-4.

1. In the IntelliStart Setup Parameters dialog box, click the Sample Tune tab.
2. For the first sample tune mass, select the check box and enter a value of 311.

3. Clear all the check boxes for other sample tune masses.
4. In the Save Sample Tune Parameters As box, enter sulfadimethoxine.

To start instrument setup

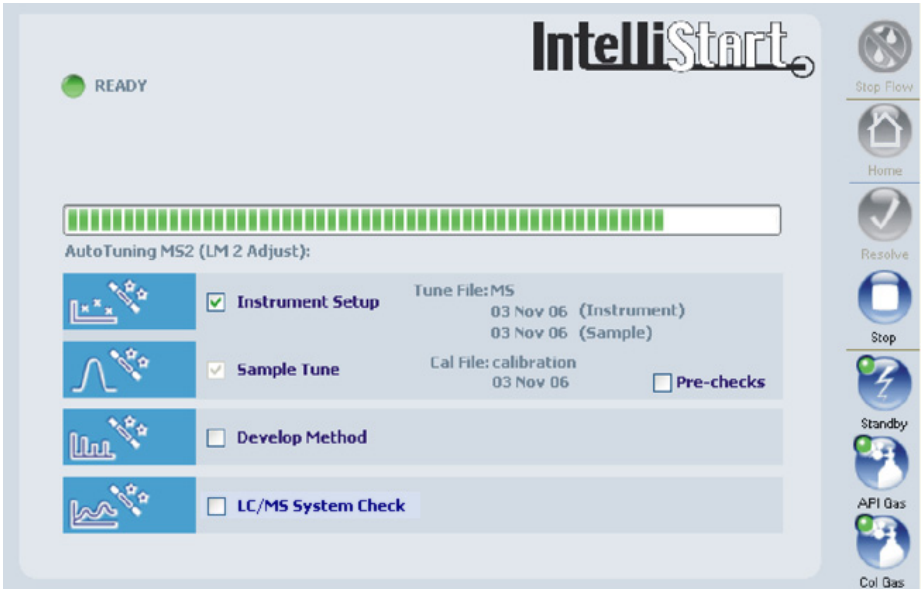
1. Click Start.

   Result: A message appears reminding you to ensure that the calibrant solutions, calibration parameters, and LC flow are set correctly.

2. Click OK.

   Result: An autotune on the calibrant is followed by automatic calibration. The console displays the progress of the setup.

Example display during calibration



IntelliStart creates tune and calibration settings, which are saved as specified on the Instrument Setup Parameters dialog box's Instrument Setup tab. Once calibration is complete, the sample tune starts on the mass defined in the IntelliStart Setup Parameters dialog box. When the sample tune is complete, the sample tune results are saved with the name sulfadimethoxine.

Performing a sample tune

In the following example, sulfadimethoxine is used as the tuning sample.

Required material: Sulfadimethoxine solution (100 pg/µL)

To perform a sample tune

1. Prepare the IntelliStart fluidics system with sulfadimethoxine solution in reservoir B. See "To prepare the IntelliStart fluidics system" on page 4-2.
2. In the console system tree, click 3100 Detector.
3. Ensure that the Ion Mode is ES+.
4. Click IntelliStart.
5. Clear the Instrument Setup check box.
6. If you require system pre-checking, select Pre-checks.

   Rationale: If Pre-checks is selected, when IntelliStart starts the sample tune, it determines whether the existing tune is still valid. If so, no sample tune is performed.

   See the detector's online Help topic "IntelliStart flow diagram".
7. Click Start.
8. In the IntelliStart Setup Parameters dialog box's Sample Tune tab, specify the sample tune parameters as described for your data system in "To specify the sample tune parameters using MassLynx software" on page 4-4 or "To specify the sample tune parameters using Empower software" on page 4-4.
9. Click Start.

   Result: A message appears reminding you to ensure that the tune solutions, tune parameters, and LC flow are set correctly.
10. Click OK.

    Result: The console displays the progress of the setup. When the sample tune is complete, the sample tune results are saved with the name sulfadimethoxine.

Developing experiment methods

IntelliStart enables you to automatically develop quantitative SIR methods for compounds of interest. Up to four compounds can be handled in a single process. In this example, a method for sulfadimethoxine is created.

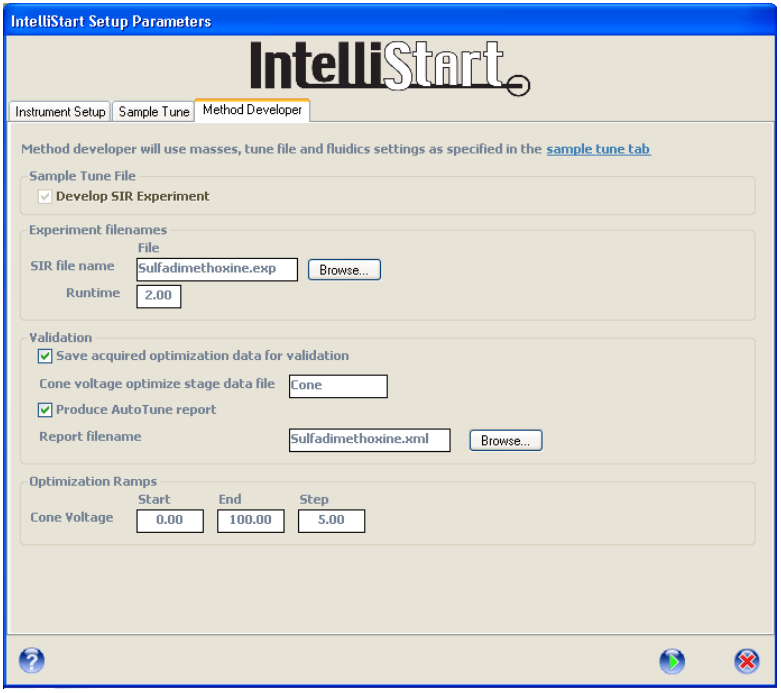
Required material: Sulfadimethoxine solution (100 pg/µL)

To create a method

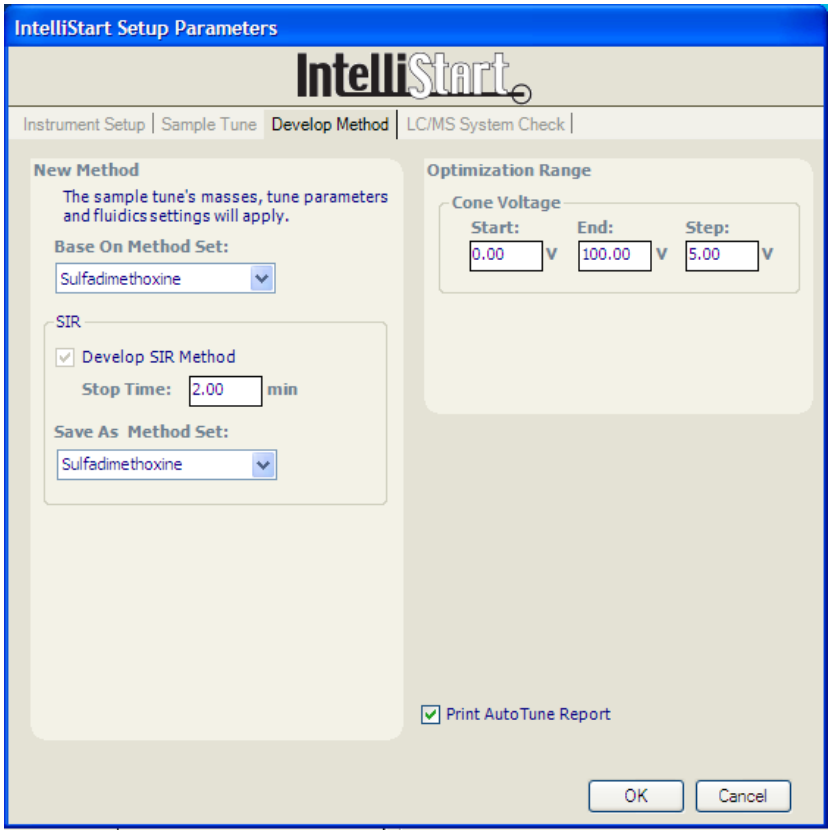
1. Prepare the IntelliStart fluidics system with sulfadimethoxine solution in reservoir B. See "To prepare the IntelliStart fluidics system" on page 4-2.
2. In the console system tree, click 3100 Detector.
3. Ensure that the Ion Mode is ES+.
4. Click IntelliStart.
5. Clear the Instrument Setup check box.
6. Click Develop Method.
7. If you require system pre-checking, select Pre-checks. See the detector's online Help topic "IntelliStart flow diagram".
8. Click Start.
9. In the IntelliStart Setup Parameters dialog box, click the Method Developer tab if you use MassLynx software, or the Develop Method tab if you use Empower software.

   Rule: The masses, tune parameters, and IntelliStart fluidics system parameters already set in IntelliStart are used.
10. Select the parameters shown in the following figures.

Method Developer tab (MassLynx)



Develop Method tab (Empower)



In this case, a method called sulfadimethoxine is created.

In MassLynx software, the validation pane selections save optimization data for validation purposes and create an autotune report file (Sulfadimethoxine.xml). In Empower software, an autotune report file is printed.

For further information on the parameters available in the Develop Method tab, see the detector's online Help.

11. Click Start.

Result: A message appears reminding you to ensure that the sample solutions, sample tune parameters, and LC flow are set correctly.

12. Click OK.

    Result: The console displays the progress of the method development. When the method development is complete, the method settings are saved with the name sulfadimethoxine.

    A green check mark indicates a successful run; a red cross indicates a failure.

Verifying the system

Using IntelliStart, you can verify that your system is performing to an acceptable standard. You can run the system verification in one of the following three ways:

- Manually from the console.
- Manually as part of an autotune sequence.
- If you use MassLynx, automatically on a scheduled time and date.

For instructions on preparing a sulfadimethoxine standard for use with the supplied LC/MS System Check projects, see "Preparing Samples for LC/MS System Check with Empower software" on page D-1.

For detailed information on setting up system verification, see the detector's online Help.

5 Maintenance Procedures

This chapter provides the maintenance guidelines and procedures necessary to maintain the instrument's performance.

Keep to a maintenance schedule, and perform maintenance as required and described in this chapter.

Contents

Contents

Maintenance schedule

The following table lists periodic maintenance schedules that ensure optimum instrument performance.

The maintenance frequencies shown apply to instruments that normally receive moderate use.

Maintenance schedule

Procedure	Frequency	For information...
Clean the instrument case.	As required.	See page 5-10.
Clean the source cleanout tray.	Check daily, clean when excessively fouled.	See page 5-10.
Empty the exhaust trap bottle in the instrument exhaust line.	Check daily, empty as required.	See page 5-15.
Empty the liquid trap bottle in the roughing pump exhaust line.	Check daily, empty as required.	See page 5-16.
Gas ballast the roughing pump.	ESI – weekly; APCI – daily.	See page 5-20.
Inspect and adjust the roughing pump oil level.	Weekly.	See page 5-23.
Clean the source components.	When sensitivity decreases to unacceptable levels.	See page 5-25.
Clean or replace the ESI probe tip.	When sensitivity decreases to unacceptable levels.	See page 5-57.
Replace the ESI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See page 5-58.

Maintenance schedule

Procedure	Frequency	For information...
Clean the APCI probe tip. (Options using the APCI IonSABRE probe only.)	When sensitivity decreases to unacceptable levels.	See page 5-65.
Replace the APCI probe capillary.	When sensitivity decreases to unacceptable levels or sample flow is inconsistent.	See page 5-65.
Clean or replace the corona pin (APCI and ESCi modes).	When the corona pin is corroded or black, or the sensitivity decreases to unacceptable levels.	See page 5-73.
Replace the APCI probe heater.	If the heater fails when the instrument is pumped down (evacuated).	See page 5-74.
Replace the ion block heater cartridge.	If the heater fails to heat when the instrument is pumped down (evacuated).	See page 5-77.
Replace the source assembly seals.	Annually.	See page 5-81.
Clean or replace the instrument's air filters.	Annually.	See page 5-91.
Change the roughing pump oil.	Annually.	See page 5-98.
Replace the roughing pump's demister element.	Annually. **Tip:** Applications that contaminate the roughing pump oil reduce this period, which must be determined from experience.	See page 5-101.

Spare parts

Waters recommends that you replace only the parts mentioned in this document. For spare parts details, see the Waters Quality Parts Locator on the Waters Web site's Services/Support page.

Safety and handling

Bear in mind the following safety considerations when performing maintenance procedures:

Warning: The instrument components can be contaminated with biologically hazardous materials. Always wear chemical-resistant, powder-free gloves while handling the components.

Warning: To prevent injury, always observe Good Laboratory Practices when handling solvents, changing tubing, or operating the instrument. Know the physical and chemical properties of the solvents used (see the Material Safety Data Sheets for the solvents in use).

Warning: To avoid electric shock,

- do not remove the instrument's panels. There are no user-serviceable items inside the instrument.
- ensure that the instrument is in Standby mode before commencing any maintenance.

Warning: The probe and source can be hot. To avoid burn injuries, take great care while working with these components.

Caution: When performing maintenance inside the source enclosure, ensure that the following criteria are met:

- Instrument is in Standby mode.
- LC flow is diverted to waste or set to off.
- Desolvation gas is turned off.

See Appendix A for safety advisory information.

Preparing the instrument for working on the source

For safety reasons, you must follow the procedure described below before working on the source (for example, when changing the probe, installing or removing the corona pin, operating the source isolation valve, and when maintaining the source).

To prepare the instrument for working on the source

1. In the console, click Standby  , and confirm that the Operate indicator is not illuminated.

   Requirement: Before you continue, stop the LC flow or divert it to waste.

2. In the console, click Stop Flow  to stop the LC flow or, if column flow is required, divert the LC flow to waste as follows:

   a. In the console system tree, expand 3100 Detector.

   b. Click Show Tune  .

   c. In the Tune window, click the Fluidics tab.

   d. In the Flow Control panel, select Waste as the flow state.

3. Wait 3 minutes to allow the desolvation gas flow to cool the probe and source.

4. In the console, click API  to stop the desolvation gas flow.

Operating the source isolation valve

You must close the source isolation valve to isolate the source from the instrument vacuum system for certain maintenance procedures.

Required material: Chemical-resistant, powder-free gloves

To close the source isolation valve before starting a maintenance procedure

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

2. Open the instrument's access door.

   Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

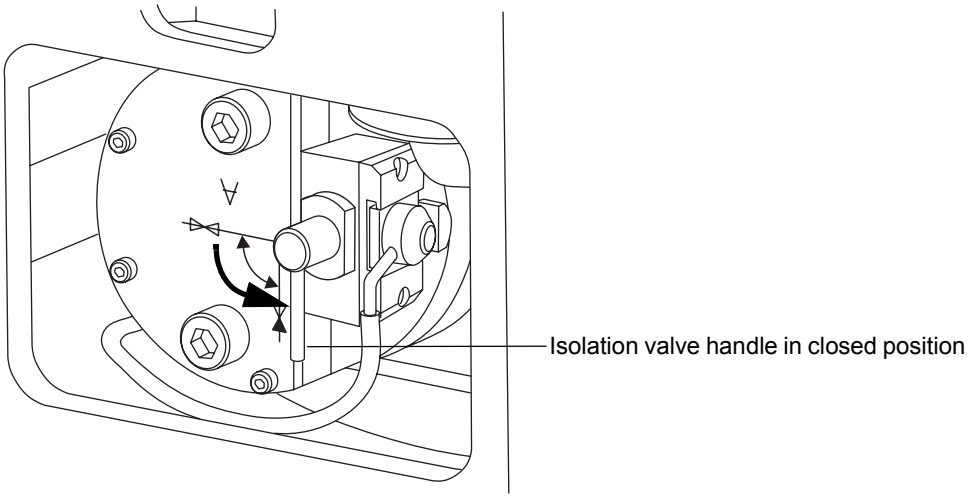
   - An ESI probe is fitted (the probe tip is sharp).
   - A corona pin is fitted (the pin tip is sharp).

   Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unfasten the source enclosure door's handle and open the door.

4. Close the source isolation valve by moving its handle counterclockwise, to the vertical position.



To open the source isolation valve after completing a maintenance procedure

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

Caution: Do not apply any downward force to the source enclosure door while the door is open.

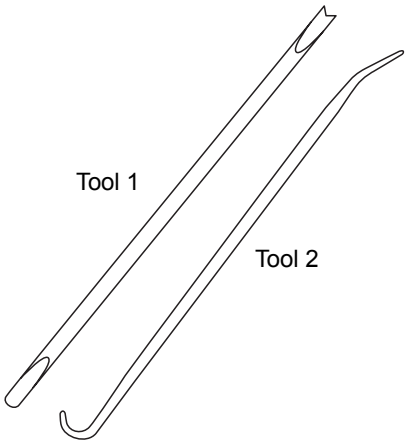
1. Open the source isolation valve by moving its handle clockwise to the horizontal position.

2. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
3. Close the instrument's access door.

Removing O-rings and seals

When performing certain maintenance procedures, you must remove O-rings or seals from instrument components. An O-ring removal kit is provided with the instrument. You must dispose of all used O-rings and seals; do not re-use old O-rings or seals on the instrument.

O-ring removal kit



To remove an O-ring

Caution: When removing an O-ring or seal from a component, be careful not to scratch the component with either removal tool.

1. Use the forked end of tool 1 to impale the O-ring or seal.

2. Pull the O-ring or seal from its groove; if necessary, use tool 2 as an aid.

   Warning: The O-ring or seal can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

3. Dispose of the O-ring or seal in accordance with local environmental regulations.

Cleaning the instrument case

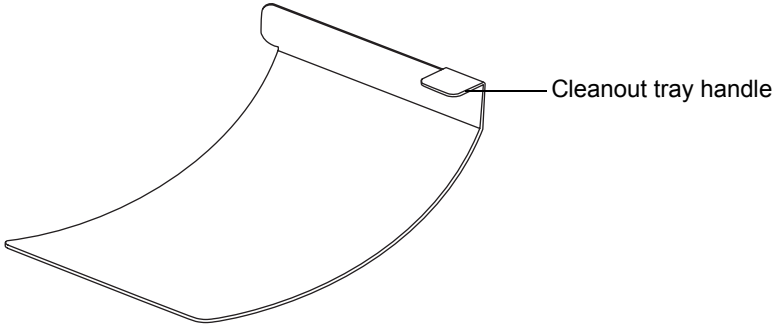
Caution: Do not use abrasives or solvents to clean the instrument's case.

Use a soft cloth, dampened with water, to clean the outside surfaces of the detector.

Cleaning the source cleanout tray

The source cleanout tray minimizes the buildup of contaminants on the floor of the source. The tray can easily be removed for cleaning; check it daily and clean it when it is excessively fouled.

Source cleanout tray



Removing the source cleanout tray from the source

Required material: Chemical-resistant, powder-free gloves

To remove the source cleanout tray

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

2. Open the instrument's access door.

   Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

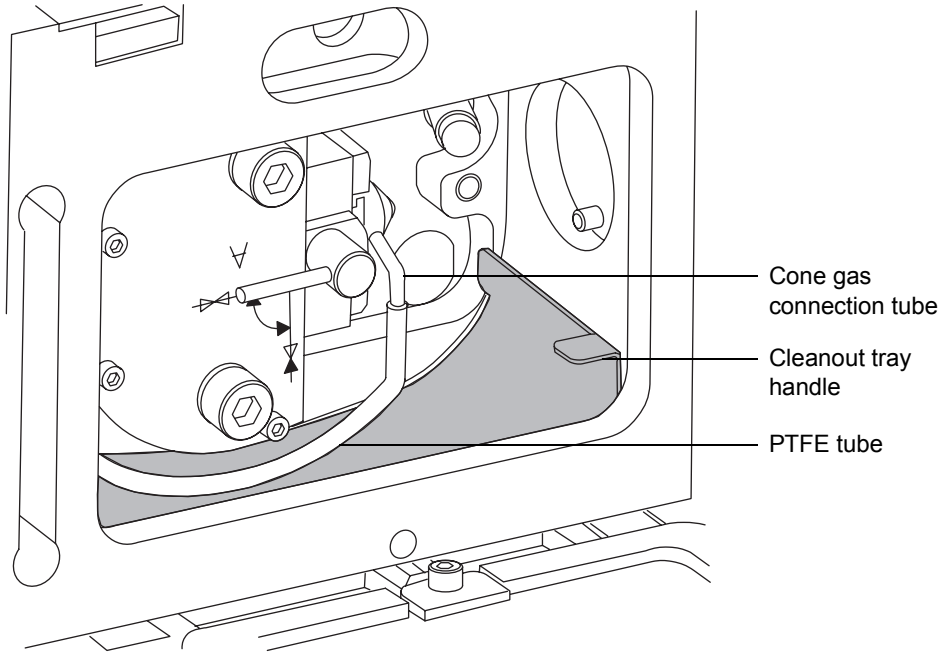
   - An ESI probe is fitted (the probe tip is sharp).
   - A corona pin is fitted (the pin tip is sharp).

   Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unfasten the source enclosure door's handle and open the door.
4. Disconnect the PTFE tube from the cone gas assembly connection tube.
5. Grasp the cleanout tray handle and carefully maneuver the cleanout tray out of the source.

Source cleanout tray in position in the source



Cleaning the source cleanout tray

Required materials:

- Chemical-resistant, powder-free gloves
- Appropriately sized glass vessel in which to completely immerse the source cleanout tray
- HPLC-grade (or better) methanol
- HPLC-grade (or better) water
- Formic acid
- Ultrasonic bath
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional)
- Wash-bottle containing HPLC-grade (or better) 1:1 methanol/water
- Large beaker

To clean the source cleanout tray

Warning: The source cleanout tray can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: Use extreme care when working with formic acid. Work in a fume hood, and use suitable protective equipment.

1. Immerse the source cleanout tray in a glass vessel containing 1:1 methanol/water.

   Tip: If the source cleanout tray is heavily contaminated, use 45:45:10 methanol/water/formic acid.

2. Place the vessel in the ultrasonic bath for 30 minutes.
3. If you used formic acid in the cleaning solution do as follows:

   a. Rinse the source cleanout tray by immersing it in a glass vessel containing water and then placing the vessel in the ultrasonic bath for 20 minutes.

   b. Displace the water by immersing the source cleanout tray in a glass vessel containing methanol and then placing the vessel in the ultrasonic bath for 10 minutes.

   Caution: To avoid recontaminating the source cleanout tray, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

4. Carefully remove the source cleanout tray from the vessel, and blow-dry with inert, oil-free gas.

Refitting the source cleanout tray to the source

Required material: Chemical-resistant, powder-free gloves

To refit the source cleanout tray

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

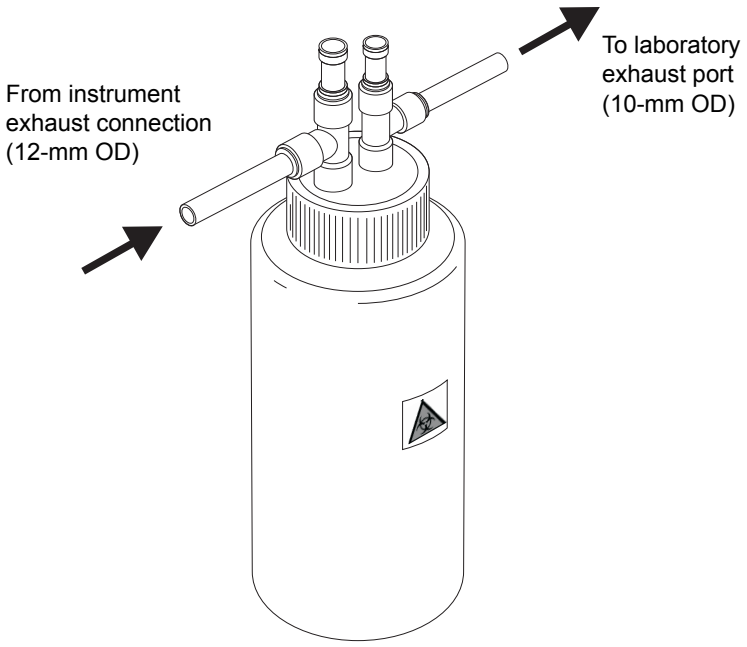
Caution: Do not apply any downward force to the source enclosure door while the door is open.

1. Grasp the cleanout tray handle and carefully maneuver the cleanout tray into the source.
2. Connect the PTFE tube to the cone gas assembly connection tube.
3. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
4. Close the instrument's access door.

Emptying the instrument exhaust trap bottle

Check the exhaust trap bottle in the instrument exhaust line daily and empty it before it is completely full.

Instrument exhaust trap bottle



Required materials:

- Chemical-resistant, powder-free gloves
- snoop® (or equivalent) leak detector liquid

To empty the exhaust trap bottle

1. In the console, click Stop Flow  to stop the LC flow.

2. In the console, click API  to stop the desolvation gas flow.

Warning: The waste liquid in the exhaust trap bottle comprises LC solvents and analytes. Always wear chemical-resistant, powder-free gloves while handling the exhaust trap bottle.

3. Unscrew and remove the exhaust trap bottle cap.

Warning: The waste liquid can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

4. Dispose of the waste liquid in accordance with local environmental regulations.
5. Fit and tighten the exhaust trap bottle cap.
6. Ensure that the exhaust trap bottle is secured in the upright position.
7. In the console, click API  to start the desolvation gas flow.
8. In the console, click Start Flow  to start the LC flow.

Warning: To confirm the integrity of the source exhaust system, the following leak test must be performed.

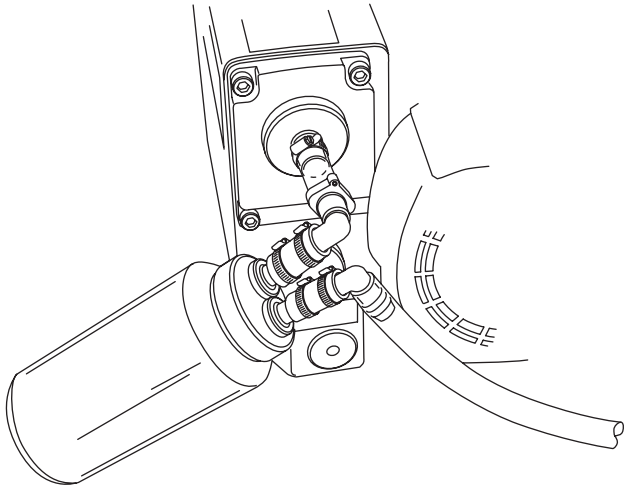
Caution: To avoid damage to the instrument, snoop (or equivalent) leak detector liquid must be used only for the purpose described in the following step; it must not be used on any other part of the instrument.

9. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the exhaust trap bottle cap.

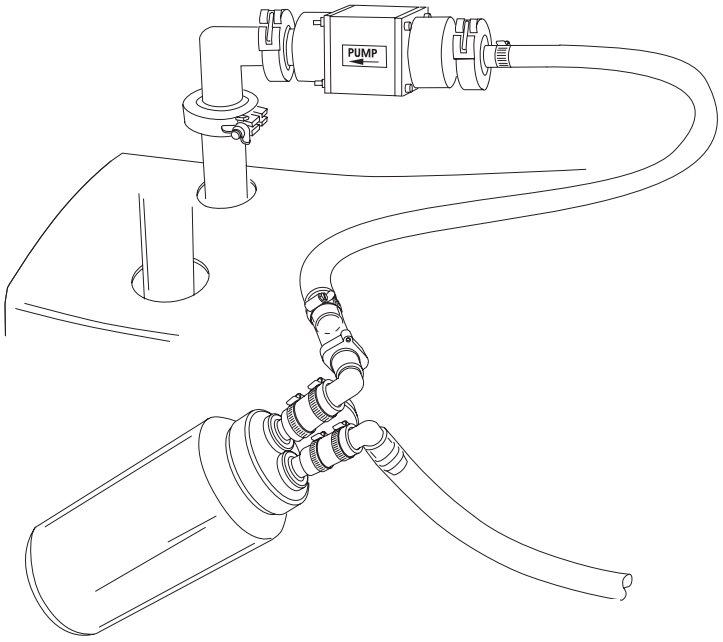
Emptying the roughing pump exhaust liquid trap bottle

Check the liquid trap bottle in the roughing pump exhaust line daily and empty it before it is completely full.

Roughing pump exhaust liquid trap bottle for an oil-filled roughing pump



Roughing pump exhaust liquid trap bottle for an oil-free roughing pump



Required materials:

- Chemical-resistant, powder-free gloves
- snoop (or equivalent) leak detector liquid

To empty the exhaust liquid trap bottle

1. Close the source isolation valve. See "Operating the source isolation valve" on page 5-7.

   Warning: The liquid in the roughing pump liquid trap bottle can be contaminated with analyte accumulated during normal operation. Always wear chemical-resistant, powder-free gloves while handling the bottle.

   Warning: To avoid burn injuries, take great care while working near the roughing pump: it can be hot.

2. Unscrew and remove the roughing pump liquid trap bottle cap.

   Warning: The waste liquid can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

3. Dispose of the waste liquid in accordance with local environmental regulations.
4. Fit and tighten the roughing pump liquid trap bottle cap.
5. Ensure that the roughing pump liquid trap bottle is secured in the upright position.
6. Open the source isolation valve. See "Operating the source isolation valve" on page 5-7.

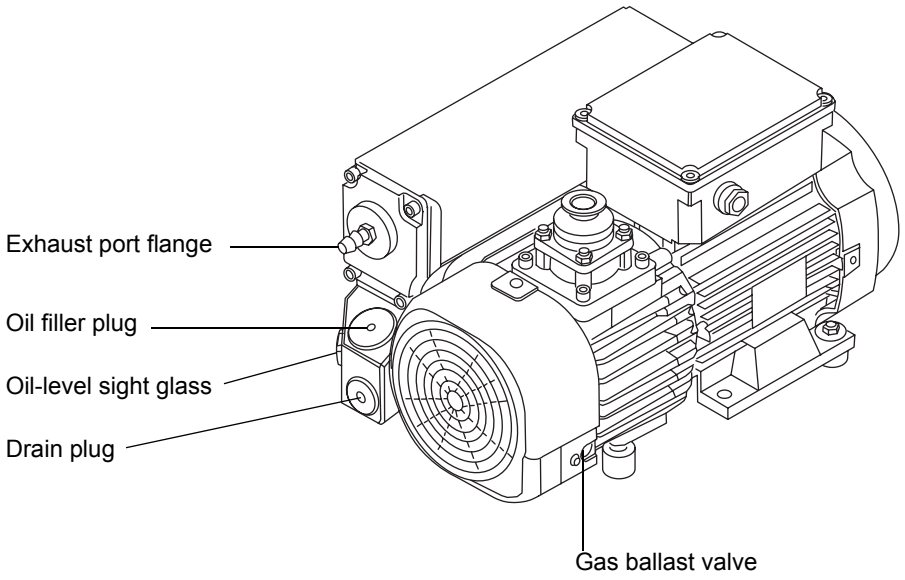
   Caution: To avoid damage to the instrument, snoop (or equivalent) leak detector liquid must be used only for the purpose described in the following step; it must not be used on any other part of the instrument.

7. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the liquid trap bottle cap.

Gas ballasting the roughing pump

Note: This procedure is not required for an Alcatel oil-free roughing pump.

Roughing pump



Caution: Failure to routinely gas ballast the roughing pump shortens oil life and, consequently, pump life.

The roughing pump draws large quantities of solvent vapors. The vapors tend to condense in the pump oil, diminishing pumping efficiency. Gas ballasting purges condensed contaminants from the oil.

Gas ballast the roughing pump when these conditions apply:

- With ESI operation, once a week.
- With frequent APCI operation, once a day.
- When the roughing pump oil appears cloudy.
- When the vacuum pressure is higher than normal.
- When condensate forms in the roughing pump exhaust line.
- When you change the roughing pump oil.

Your roughing pump can be fitted with either of the following:

- A screwdriver-operated gas ballast valve. See “Gas ballasting a pump fitted with a screwdriver-operated gas ballast valve” on page 5-21.
- A handle-operated gas ballast valve. See “Gas ballasting a pump fitted with a handle-operated gas ballast valve” on page 5-22.

Gas ballasting a pump fitted with a screwdriver-operated gas ballast valve

Required material: Flat-blade screwdriver

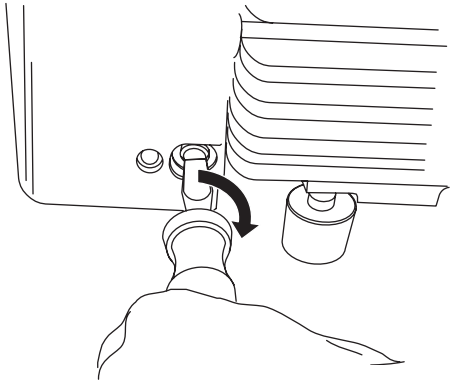
To gas ballast the roughing pump

Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

Caution: To avoid damage,

- do not vent the instrument when the roughing pump is gas ballasting.
- do not gas ballast the roughing pump while the detector is in Operate mode.
- avoid gas ballasting the roughing pump for more than 2 hours.

1. Use the flat-blade screwdriver to turn the gas ballast valve on the pump a quarter-turn to the open, ⏀, position.



2. Run the pump for 30 to 60 minutes.

   Tip: It is normal for the roughing pump temperature to increase during ballasting. To maintain an ambient temperature of <40 □C (104 □F) where the pump is located, ensure there is adequate ventilation.

3. Use the flat-blade screwdriver to turn the gas ballast valve to the closed, ⊖, position.

Gas ballasting a pump fitted with a handle-operated gas ballast valve

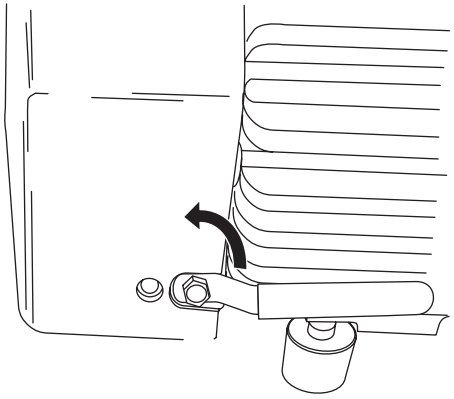
To gas ballast the roughing pump

Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

Caution: To avoid damage,

- do not vent the instrument when the roughing pump is gas ballasting.
- do not gas ballast the roughing pump while the detector is in Operate mode.
- avoid gas ballasting the roughing pump for more than 2 hours.

1. Move the gas ballast valve handle on the pump a counterclockwise from the horizontal position to the vertical position.



2. Run the pump for 30 to 60 minutes.

   Tip: It is normal for the roughing pump temperature to increase during ballasting. To maintain an ambient temperature of <40 □C (104 □F) where the pump is located, ensure there is adequate ventilation.

3. Move the gas ballast valve handle on the pump clockwise from the vertical position to the horizontal position.

Checking the roughing pump oil level

Caution: To ensure correct operation of the roughing pump, do not operate the pump with the oil level at less than 30% of the MAX level.

Note: This procedure is not required for an Alcatel oil-free roughing pump.

Requirement: You must check the oil level while the roughing pump is running.

The roughing pump oil level appears in the roughing pump's oil level sight glass. Check the oil level at weekly intervals; you must maintain the oil level so that it is at or near the MAX level when the pump is not operating.

Tip: The oil level in the sight glass is lower when the roughing pump is running than when it is stopped. When the pump is running, the oil level is typically at 30% to 60% of the MAX level. For further information, see the figure "Roughing pump" on page 5-20 and "Adding oil to the roughing pump" on page 5-23.

Adding oil to the roughing pump

If you check the roughing pump oil level and it is found to be low, you must add oil to the roughing pump. See "Checking the roughing pump oil level" on page 5-23.

Required materials:

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Container to catch used oil
- Funnel
- Anderol vacuum oil, type GS 495

To add oil to the roughing pump

1. Vent and shut-down the detector. See "Shutting down the detector" on page 2-12 for more details.

   Warning: The pump oil can be contaminated with analyte accumulated during normal operation. Always wear chemical-resistant, powder-free gloves when adding or replacing oil.

   Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

2. Use the 8-mm Allen wrench to unscrew and remove the roughing pump's oil filler plug. See the figure "Roughing pump" on page 5-20.

   Caution: To maintain pump performance, use only Anderol vacuum oil, type GS 495.

3. Using the funnel, add Anderol vacuum oil, type GS 495, into the oil filler aperture until the oil reaches the oil level sight glass MAX level.

4. Ensure that the O-ring on the oil filler plug is clean and properly seated.

   Caution: To avoid oil leakage, when fitting the oil filler plug to the roughing pump,

   - ensure that the plug is not cross-threaded.
   - ensure that the O-ring is not pinched.
   - do not over-tighten the plug.

5. Use the 8-mm Allen wrench to fit and tighten the roughing pump's oil filler plug.

   Tip: When the oil filler plug is tightened, the plug seals with an O-ring. Compression is controlled by the O-ring groove depth in the plug. Increased torque does not improve the plug seal; it only makes the plug difficult to remove later.

6. Start the detector. See "Starting the detector" on page 2-2.

   Tips: After you add oil to the pump, the following situations can occur:

   - The oil level drops slightly during the first month of operation.
   - The oil changes color (darkens) over time.

- After running the pump for 12 to 48 hours, it is common to see a few drops of oil near the filler plug. Excess oil around the lip of the filler plug will run down and drip off the pump once the pump reaches operating temperature.
- When the pump begins to run at normal operating temperature, spilled oil smells slightly.

Cleaning the source components

Clean the sample cone and gas cone when these conditions apply:

- The sample cone and gas cone are visibly fouled.
- LC and sample-related causes for decreased signal intensity have been dismissed.

See "Cleaning the sample cone and gas cone" on page 5-25.

If cleaning the sample cone and gas cones fails to increase signal sensitivity, also clean the ion block, isolation valve, and extraction cone. See "Cleaning the ion block, isolation valve, and extraction cone" on page 5-35.

If cleaning the ion block, isolation valve, and extraction cone fails to increase signal sensitivity, also clean the source hexapole assembly. See "Cleaning the source hexapole assembly" on page 5-51.

Cleaning the sample cone and gas cone

The cone gas assembly (comprising the sample cone, O-ring, and gas cone) can be removed for cleaning without venting the instrument.

Removing the cone gas assembly from the source

Required material: Chemical-resistant, powder-free gloves

To remove the cone gas assembly from the source

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is in Standby mode before commencing this procedure.

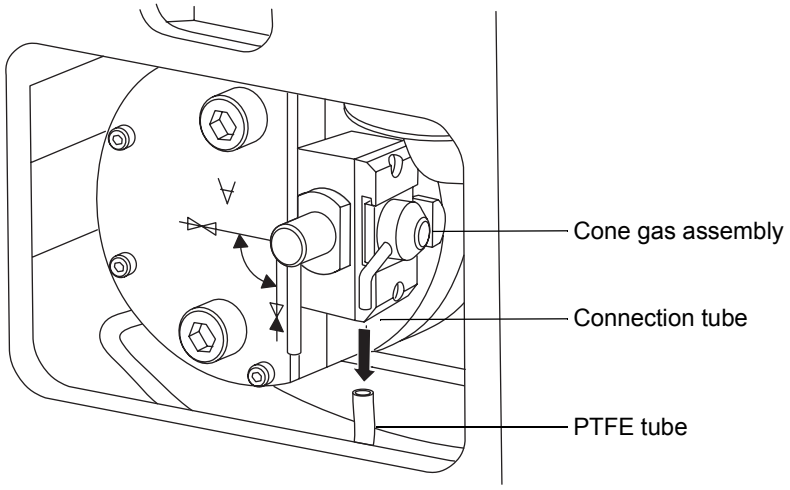
Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

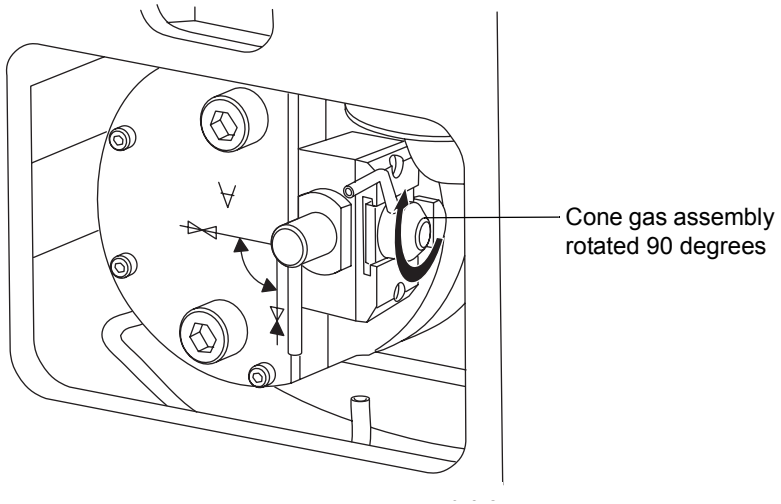
Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

1. Close the source isolation valve. See "Operating the source isolation valve" on page 5-7.
2. Disconnect the PTFE tube from the cone gas assembly connection tube.

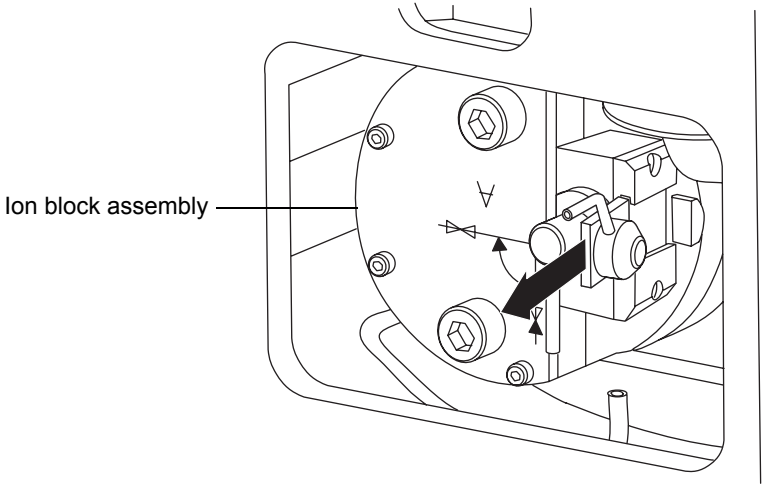


3. Grasp the cone gas assembly connection tube, and use it as a lever to rotate the cone gas assembly 90 degrees, moving the connection tube from the vertical to the horizontal position.



Caution: Do not open the isolation valve at any time when the cone gas assembly has been removed from the ion block assembly.

4. Slide the cone gas assembly out of the ion block assembly.



Disassembling the cone gas assembly

Required material: Chemical-resistant, powder-free gloves

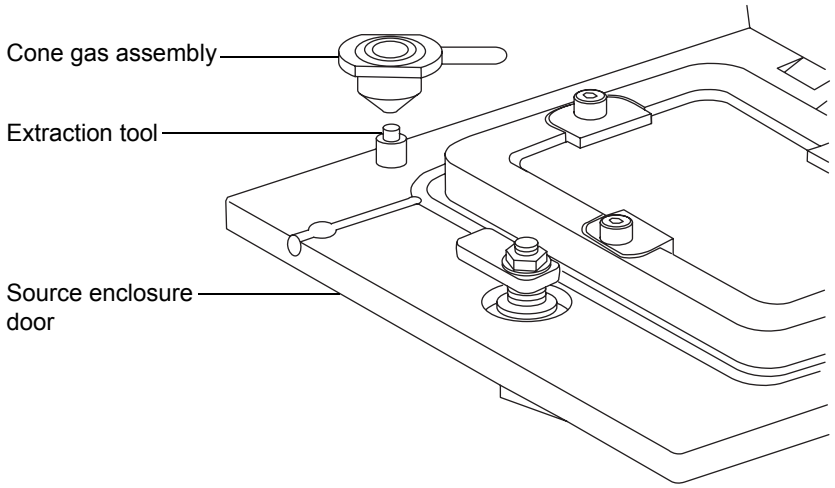
To disassemble the cone gas assembly

Warning: The cone gas assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Caution: Do not apply excessive force to the source enclosure door when using the extraction tool on the source door.

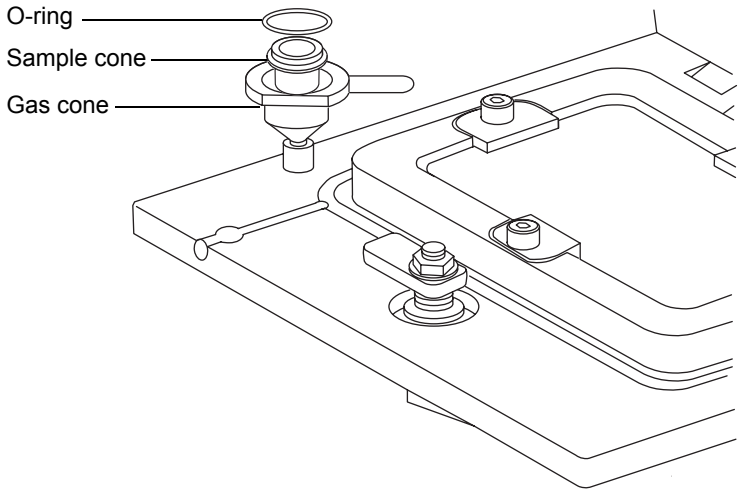
1. Position the cone gas assembly inlet over the extraction tool on the source enclosure door.

   Alternative: Use the hand-held extraction tool supplied with the instrument. This tool is used in a similar manner to that fitted to the source enclosure door.



Caution: The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

2. Carefully push down on the gas cone to separate the gas cone, sample cone, and O-ring.



Warning: The O-ring can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

3. Dispose of the O-ring in accordance with local environmental regulations.

Cleaning the sample cone and gas cone

Required materials:

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessels in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.

- Formic acid.
- Ultrasonic bath.
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional).
- Wash-bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.

To clean the sample cone and gas cone

Warning: The sample cone and gas cone can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: Use extreme care when working with formic acid. Work in a fume hood, and use suitable protective equipment.

Caution: The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

1. If the sample cone contains debris, place a drop of formic acid on its orifice.
2. Immerse the sample cone and gas cone separately in glass vessels containing 1:1 methanol/water.

   Tip: If the components are obviously contaminated, use 45:45:10 methanol/water/formic acid.
3. Place the vessels in the ultrasonic bath for 30 minutes.
4. If you used formic acid in the cleaning solution, do as follows:

   a. Rinse the components by immersing them separately in glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.

   b. Displace the water by immersing the components in separate glass vessels containing methanol and then placing the vessels in the ultrasonic bath for 10 minutes.

Caution: To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

5. Carefully remove the components from the vessels, and blow-dry them with inert, oil-free gas.
6. Inspect each component for persisting contamination. If contamination is present, do as follows:
   a. Use the wash-bottle containing 1:1 methanol/water to rinse the component over the large beaker.
   b. Blow-dry the component with inert, oil-free gas.
7. Inspect each component for persisting contamination. If contamination is present, dispose of the component, and obtain a new one before reassembling the cone gas assembly.

Assembling the cone gas assembly

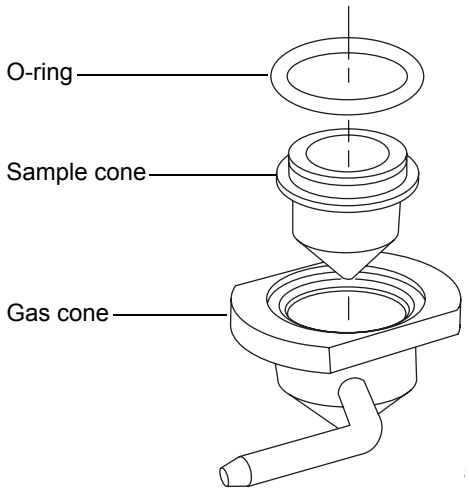
Required material: Chemical-resistant, powder-free gloves

To assemble the cone gas assembly

Caution:

- To avoid recontaminating the cone gas assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
- The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

1. Carefully fit the sample cone into the gas cone.



2. Fit a new O-ring into the groove created between the sample cone and gas cone.

Fitting the cone gas assembly to the source

Required material: Chemical-resistant, powder-free gloves

To fit the cone gas assembly to the source

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

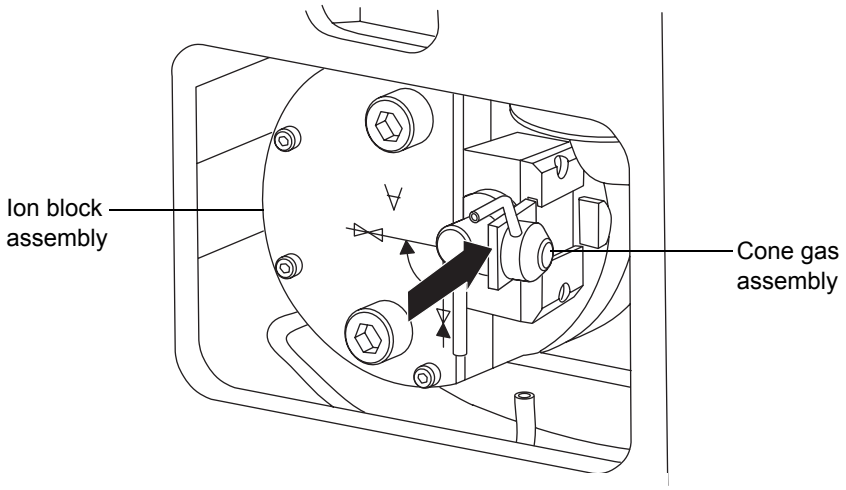
- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

Caution: To avoid damage,

- do not apply any downward force to the source enclosure door while the door is open.
- do not open the source isolation valve before fitting the cone gas assembly to the ion block assembly.

1. Ensure that the source isolation valve is in the closed position. See "Operating the source isolation valve" on page 5-7.

2. Hold the cone gas assembly so that the connection tube is horizontal and at the top, then slide the cone gas assembly into the ion block assembly.



3. Grasp the cone gas assembly connection tube and use it as a handle to rotate the cone gas assembly 90 degrees, moving the connection tube from the horizontal to the vertical position.
4. Connect the PTFE tube to the cone gas assembly connection tube.
5. Open the source isolation valve.
6. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
7. Close the instrument's access door.

Cleaning the ion block, isolation valve, and extraction cone

The ion block and extraction cone must be cleaned if cleaning the sample cone and gas cone fails to increase signal sensitivity.

Removing the ion block assembly from the source assembly

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm Allen wrench

To remove the ion block assembly

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Vent and shut-down the detector. See "Shutting down the detector" on page 2-12.

   Warning: The source can be hot. To avoid burn injuries, allow it to cool for at least 30 minutes before proceeding.

2. Open the instrument's access door.

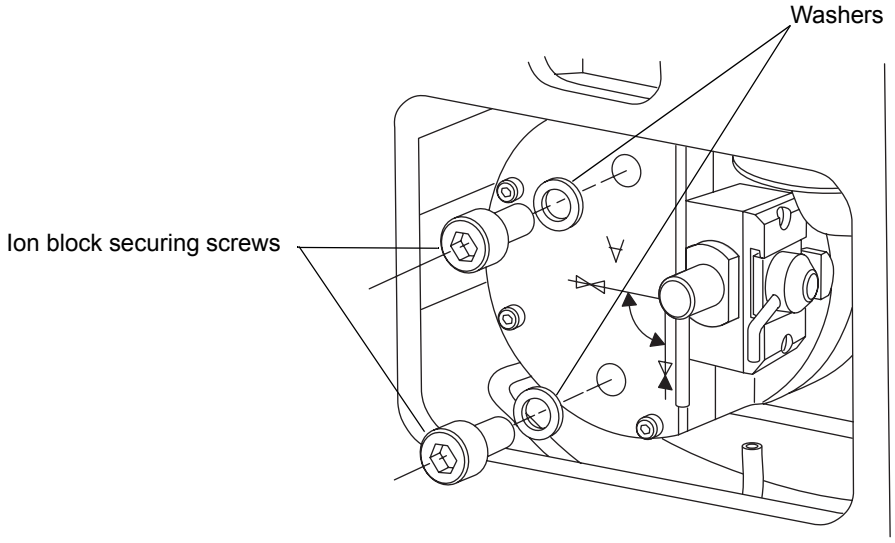
   Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:
   - An ESI probe is fitted (the probe tip is sharp).
   - A corona pin is fitted (the pin tip is sharp).

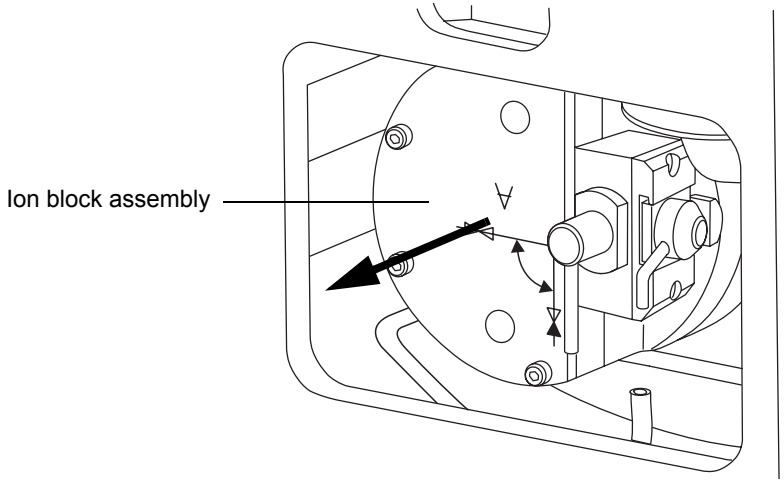
   Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unfasten the source enclosure door's handle and open the door.
4. Close the source isolation valve. See "Operating the source isolation valve" on page 5-7.

5. Disconnect the PTFE tube from the cone gas assembly connection tube.
6. Use the 6-mm Allen wrench to unscrew and remove the 2 ion block assembly securing screws and associated washers.



7. Remove the ion block assembly from the PEEK ion block support.



Disassembling the source ion block assembly

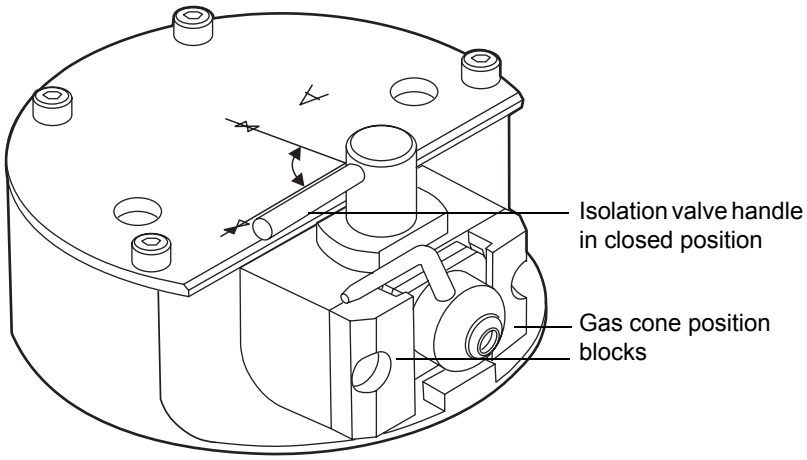
Required materials:

- Chemical-resistant, powder-free gloves
- 2.5-mm and 6-mm Allen wrenches
- O-ring removal kit
- Needle-nose pliers

To disassemble the ion block assembly

Warning: The ion block assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Ensure that the isolation valve is closed.

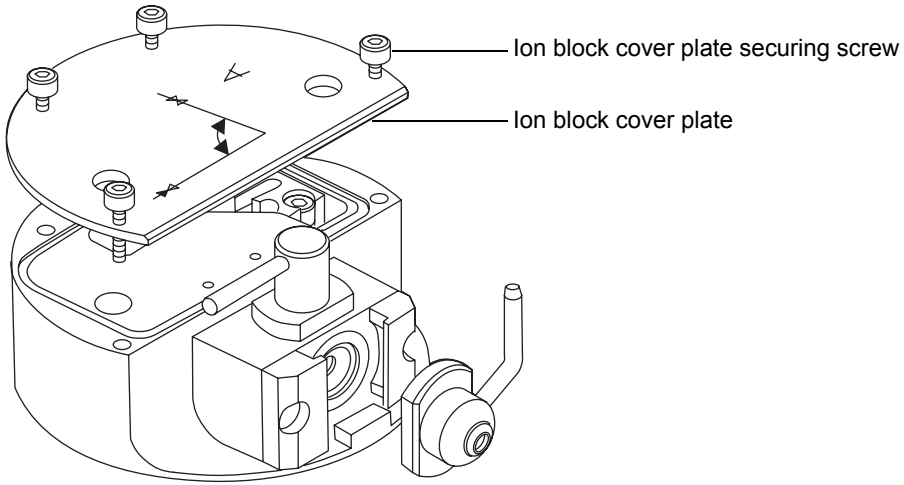


2. Grasp the cone gas assembly connection tube and use it as a lever to rotate the cone gas assembly 90 degrees.

Caution: To ensure correct operation of the ion block assembly after reassembly,

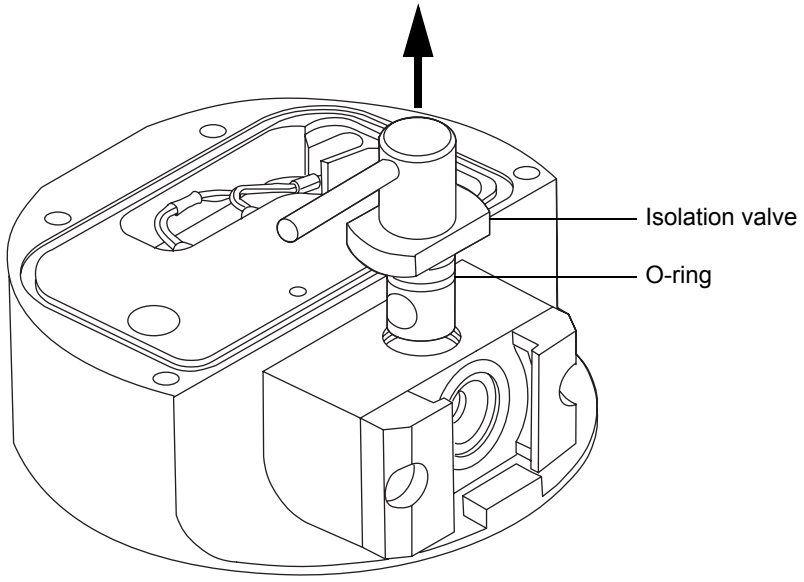
- the gas cone position block must not be removed
- the screws holding the gas cone position blocks in place must not be adjusted.

3. Slide the cone gas assembly out of the ion block assembly.
4. Use the 2.5-mm Allen wrench to loosen the 4 ion block cover plate captive securing screws.



5. Remove the ion block cover plate.

6. Grasp the isolation valve and pull it out of the ion block.

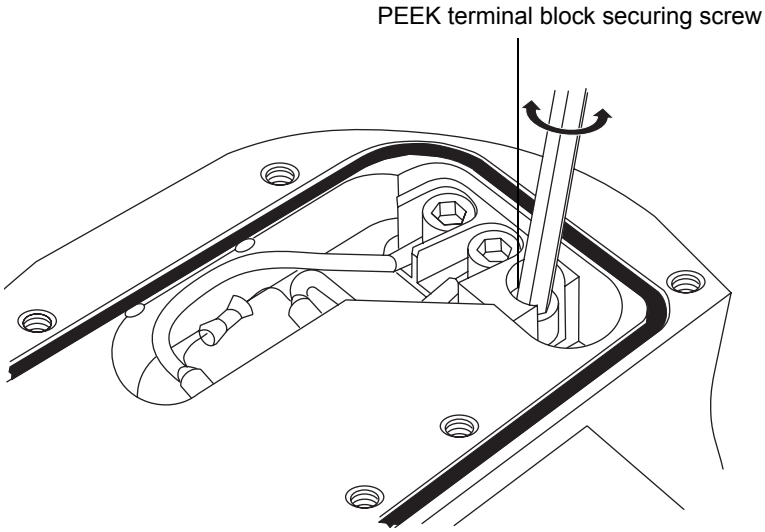


7. Use the O-ring removal kit to carefully remove the isolation valve O-ring. See "Removing O-rings and seals" on page 5-9.

Warning: The isolation valve O-ring can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

8. Dispose of the isolation valve O-ring in accordance with local environmental regulations.

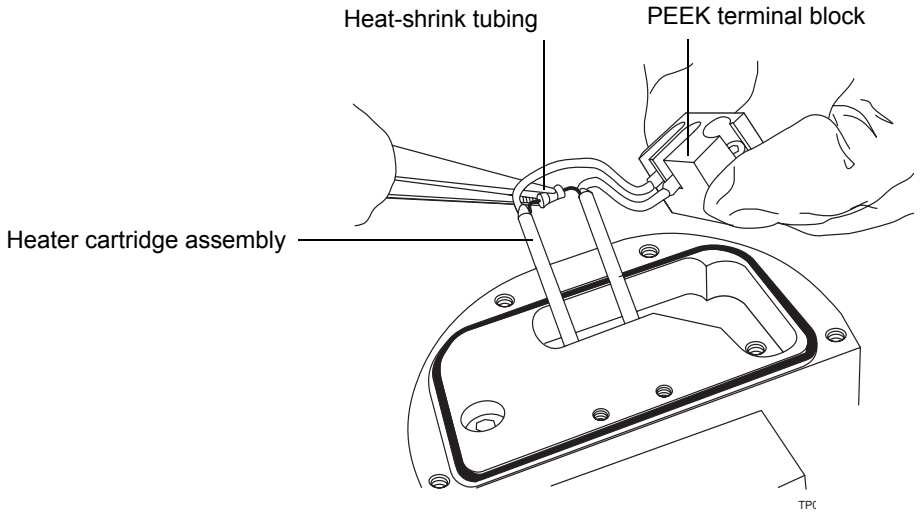
9. Use the 2.5-mm Allen wrench to loosen the captive PEEK terminal block securing screw.



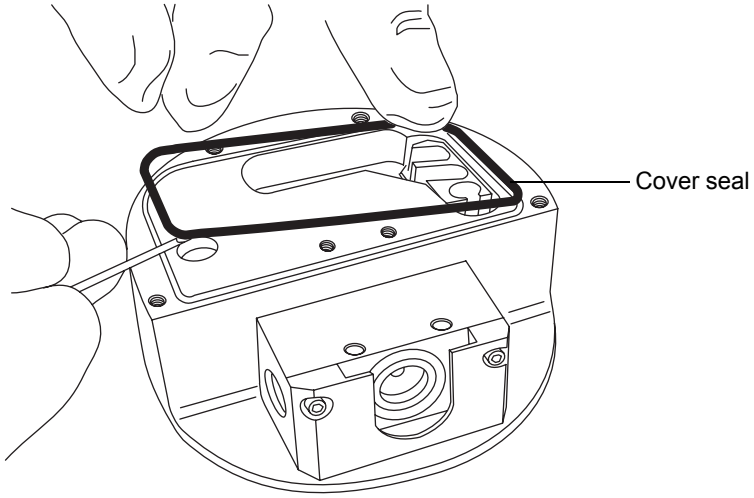
Caution: To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when removing the assembly from the ion block.

10. Use the needle-nose pliers to grasp the PEEK terminal block and partially lift it out of the ion block.

11. Holding the PEEK ion block gently, use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly and slide it and the PEEK terminal block out of the ion block.

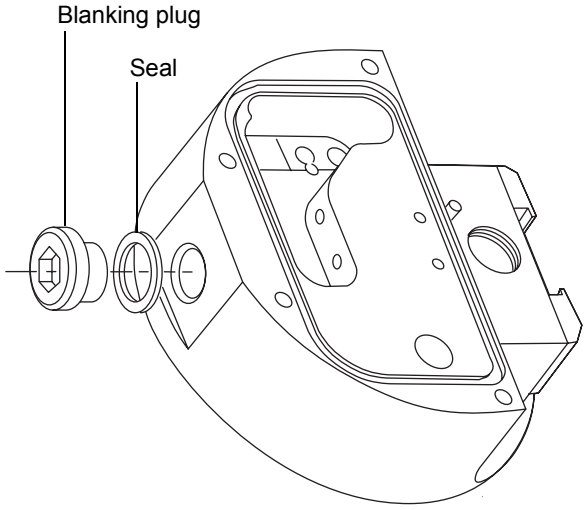


12. Use the O-ring removal kit to carefully remove the cover seal from the ion block. See also “Removing O-rings and seals” on page 5-9.



Warning: The cover seal can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

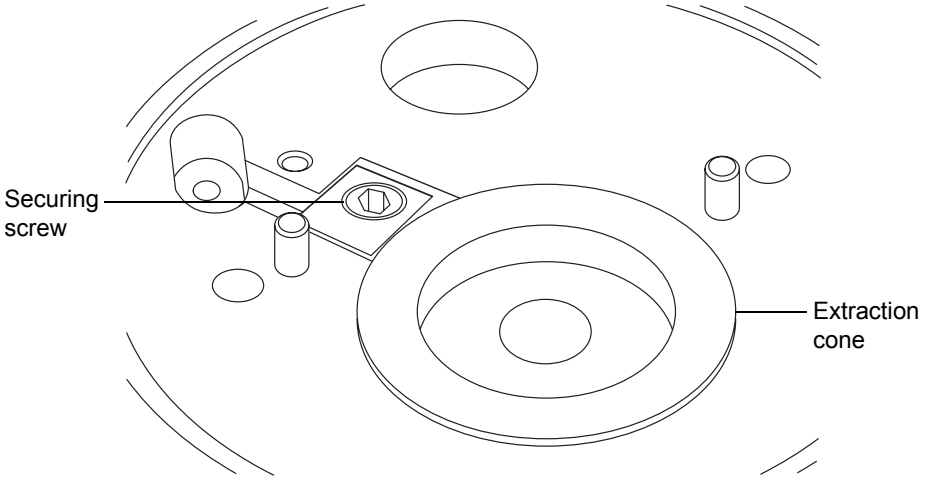
13. Dispose of the cover seal in accordance with local environmental regulations.
14. Use the 6-mm Allen wrench to remove the ion block blanking plug and associated seal.



Warning: The blanking plug seal can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

15. Dispose of the blanking plug seal in accordance with local environmental regulations.

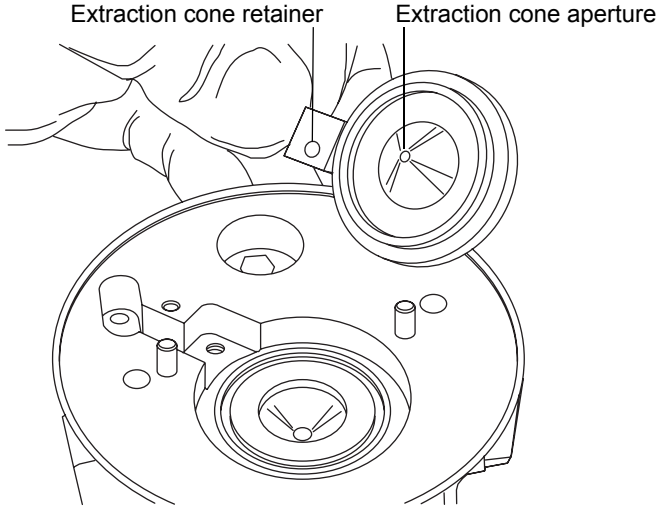
16. Use the 2.5-mm Allen wrench to loosen the captive extraction cone retainer securing screw.



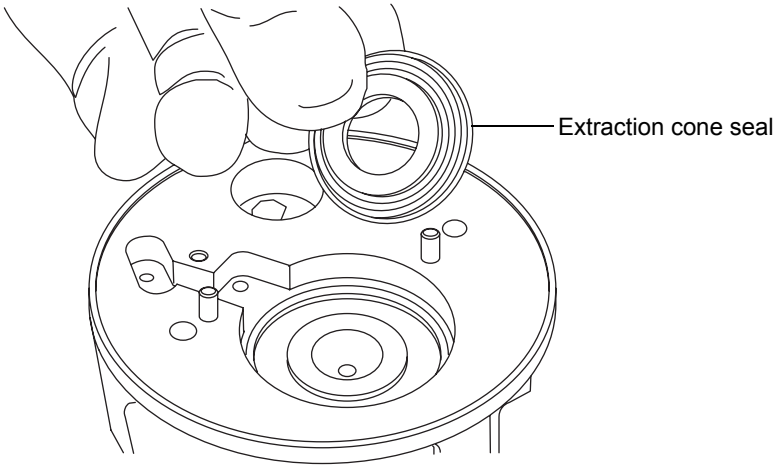
Caution:

- Take great care not to damage the extraction cone aperture when removing the extraction cone from the ion block.
- The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.

17. Remove the extraction cone retainer and extraction cone from the ion block.



18. Remove the extraction cone retainer from the extraction cone.
19. Remove the extraction cone seal from the ion block.



Cleaning the ion block, isolation valve, and extraction cone

Required materials:

- Chemical-resistant, powder-free gloves.
- Appropriately sized glass vessels in which to completely immerse components when cleaning. Use only glassware not previously cleaned with surfactants.
- HPLC-grade (or better) methanol.
- HPLC-grade (or better) water.
- Formic acid.
- Ultrasonic bath.
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional).
- Wash-bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.

To clean the ion block components

Warning: The ion block components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: Use extreme care when working with formic acid. Use a fume hood and appropriate protective equipment.

Caution: The extraction cone is fragile. Never place it on its tip; always place it on its flanged base.

1. Immerse the ion block, isolation valve, and extraction cone separately in glass vessels containing 1:1 methanol/water.

Caution: To avoid damage, do not clean non-metal parts (for example, the heater cartridge assembly) in this way.

Tip: If the components are obviously contaminated, use 45:45:10 methanol/water/formic acid.

2. Place the vessels in the ultrasonic bath for 30 minutes.
3. If you used formic acid in the cleaning solution, do as follows:
   a. Rinse the components by immersing them separately in glass vessels containing water and then placing the vessels in the ultrasonic bath for 20 minutes.
   b. Displace the water by immersing the components separately in glass vessels containing methanol and then placing the vessels in the ultrasonic bath for 10 minutes.

Caution: To avoid recontaminating the components, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

4. Carefully remove the components from the vessels, and blow-dry them using inert, oil-free gas.

5. Inspect each component for persisting contamination. If contamination is present, do as follows:

    a. Use the wash-bottle containing 1:1 methanol/water to rinse the component over the large beaker.

    b. Blow-dry the component with inert, oil-free gas.

6. Inspect each component for persisting contamination. If contamination is present, dispose of the component, and obtain a new one before reassembling the cone gas assembly.

Assembling the source ion block assembly

Required materials:

- Chemical-resistant, powder-free gloves
- 1.5-mm, 2.5-mm, and 6-mm Allen wrenches
- Needle-nose pliers
- Isopropyl alcohol in small container

To assemble the ion block assembly

Caution:

- To avoid recontaminating the ion block assembly, wear clean chemical-resistant, powder-free gloves during this procedure.
- The sample cone is fragile. Never place it on its tip; always place it on its flanged base.

1. Fit the extraction cone seal to the ion block.
2. Fit the extraction cone retainer to the extraction cone.

    Caution: Take great care not to damage the extraction cone aperture when fitting the extraction cone to the ion block.

3. Fit the extraction cone retainer and extraction cone to the ion block.
4. Use the 2.5-mm Allen wrench to tighten the captive screw securing the extraction cone retainer.
5. Fit a new blanking plug seal to the ion block blanking plug.

6. Use the 6-mm Allen wrench to fit and tighten the blanking plug to the ion block.

   Caution: To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when fitting the assembly to the ion block.

7. Using the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly, slide the assembly and the PEEK terminal block into the ion block.
8. Use the 2.5-mm Allen wrench to tighten the captive PEEK terminal block securing screw.
9. Ensure that the grooves for the cover seal and extraction cone seal are free from dirt and debris.

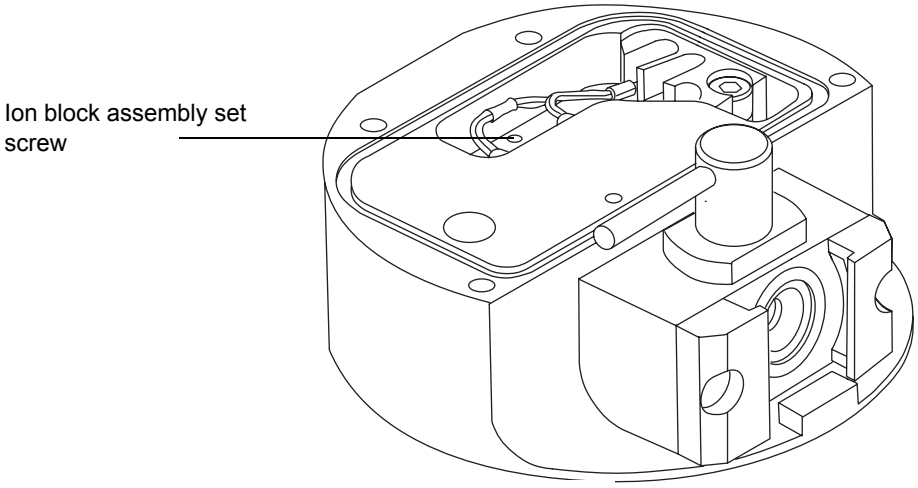
   Tip: If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.

10. Fit a new cover seal to the ion block, ensuring that it is correctly seated.
11. Soak a new isolation valve O-ring in isopropyl alcohol for a few minutes.

    Rationale: Doing so lubricates the O-ring and aids your fitting the O-ring to the isolation valve.

12. Fit the new O-ring to the isolation valve.
13. Fit the isolation valve to the ion block assembly.

14. If an ion block assembly set screw is fitted, use the 1.5 mm Allen wrench to loosen the set screw. If an ion block assembly set screw is not fitted go to step 18.



15. To tighten the ion block assembly set screw, hold the ion block in position against the PEEK ion block support on the instrument.

    Caution: To avoid damage to the thermocouple, do not overtighten the set screw.

16. Carefully tighten the set screw until it makes contact with the thermocouple.
17. Remove the ion block from the PEEK ion block support on the instrument.
18. Fit the ion block cover plate to the ion block assembly, and then use the 2.5-mm Allen wrench to tighten the 4 ion block cover plate captive securing screws.
19. Holding the cone gas assembly so that the connection tube is horizontal and at the top, slide the cone gas assembly into the ion block assembly.
20. Grasp the cone gas assembly connection tube, and use it as a handle to rotate the cone gas assembly 90 degrees, moving the connection tube from the horizontal to the vertical position.

Fitting the ion block assembly to the source assembly

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm Allen wrench

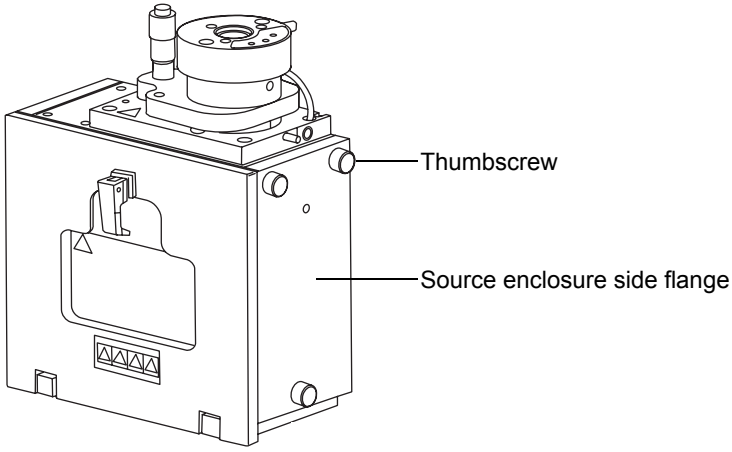
To fit the ion block assembly

Warning: To avoid puncture wounds, take great care while working with the source enclosure door open if one or both of these conditions apply:

- An ESI probe is fitted (the probe tip is sharp).
- A corona pin is fitted (the pin tip is sharp).

Caution: To avoid recontaminating the ion block assembly, wear clean chemical-resistant, powder-free gloves during this procedure.

1. Unscrew and remove the 3 thumbscrews that secure the right-hand side flange to the source enclosure.



2. Remove the side flange from the source enclosure.

   Rationale: This step allows you to see the ion block assembly as you fit it to the PEEK ion block support.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unfasten the source enclosure door's handle and open the door.
4. Fit the ion block assembly to the PEEK ion block support.
5. Use the 6-mm Allen wrench to fit and then slowly and evenly tighten the 2 ion block assembly securing screws and their associated washers.
6. Look through the hole in the side of the source enclosure and view the area where the ion block assembly meets the PEEK ion block support. If you see a gap, the extraction cone has slipped out of position during installation. If this is the case, remove the ion block assembly, refit the extraction cone, and reinstall the ion block assembly on the PEEK ion block support.
7. When you are satisfied with the installation of the ion block assembly, fit the side flange to the source enclosure.
8. Fit and tighten the 3 thumbscrews that secure the right-hand side flange to the source enclosure.
9. Connect the PTFE tube to the cone gas assembly connection tube.
10. Open the source isolation valve. See "Operating the source isolation valve" on page 5-7.
11. Close the source enclosure door and fasten its handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.

Cleaning the source hexapole assembly

The source hexapole assembly must be cleaned if cleaning the ion block, isolation valve, and extraction cone fails to increase signal sensitivity.

Removing the ion block assembly, ion block support, and hexapole from the source assembly

Required materials:

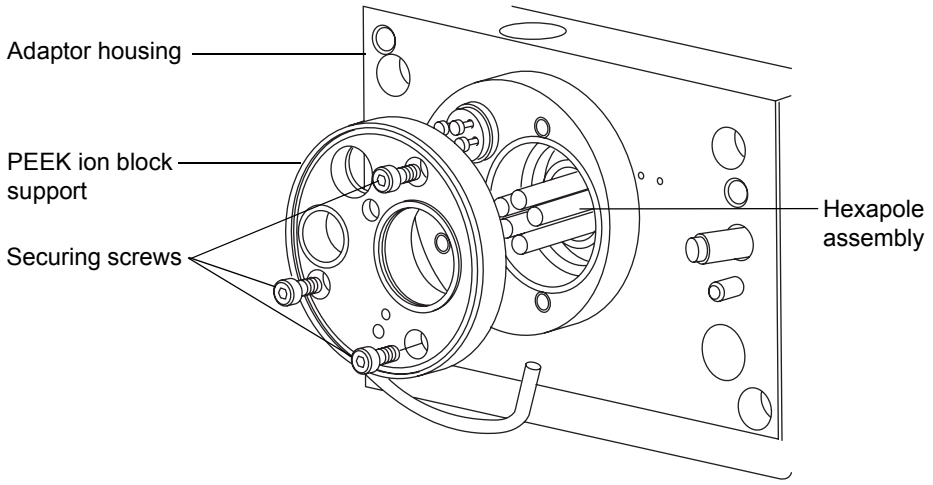
- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- O-ring removal kit

To remove the ion block assembly, ion block support, and hexapole

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the ion block assembly from the PEEK ion block support. See "Removing the ion block assembly from the source assembly" on page 5-35.

2. Use the 3-mm Allen wrench to unscrew and remove the 3 screws securing the PEEK ion block support to the adaptor housing.



3. Remove the PEEK ion block support from the adaptor housing.
4. Use the O-ring removal kit to carefully remove all the O-rings from the PEEK ion block support. See "Removing O-rings and seals" on page 5-9.

Warning: The O-rings can be contaminated with biohazardous and/or toxic materials. Ensure that they are correctly disposed of according to local environmental regulations.

5. Dispose of the O-rings in accordance with local environmental regulations.

Caution: To avoid damage, when removing the hexapole assembly from the adaptor housing, observe these precautions:

- Avoid scratching the internal surfaces of the adaptor block.
- Do not compress the hexapole rods.

6. Carefully grasp the source hexapole assembly and remove it from the adaptor housing.

Cleaning the hexapole assembly

Required materials:

- Chemical-resistant, powder-free gloves.
- 500-mL measuring cylinder or appropriately sized glass vessel in which to completely immerse the hexapole when cleaning. Use only glassware not previously cleaned with surfactants.
- Length of small diameter stainless steel tube.
- HPLC-grade (or better) methanol.
- Ultrasonic bath.
- Source of oil-free, inert gas (nitrogen or helium) for drying (air-drying optional).
- HPLC-grade (or better) 1:1 methanol/water.
- Wash-bottle containing HPLC-grade (or better) 1:1 methanol/water.
- Large beaker.
- Small, flat-blade screwdriver.

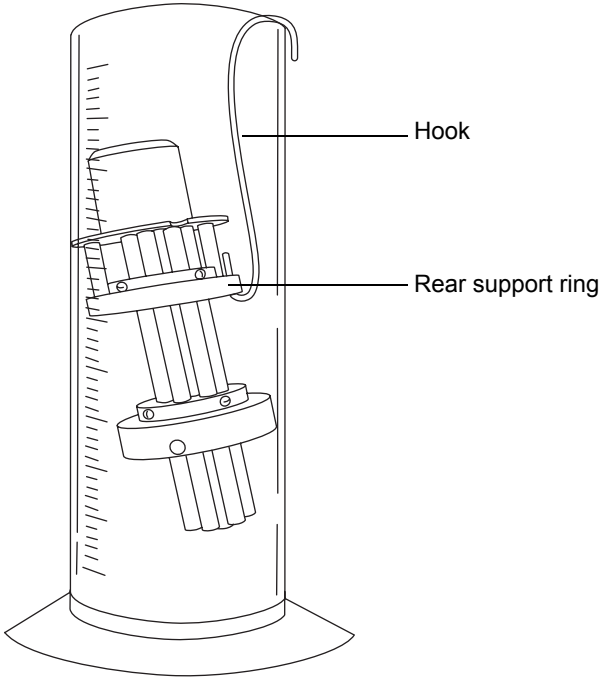
To clean the source hexapole assembly

Warning: The source hexapole assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Bend the stainless steel tube into a hook shape.
2. Insert one end of the hook into one of the holes on the hexapole assembly's rear support ring.

Caution: To avoid vibration damage to the hexapole assembly, ensure that the bottom of the assembly is not in contact with the bottom of the glass vessel.

3. Use the hook to carefully suspend the hexapole assembly into the glass vessel with the bottom of the assembly clear of the bottom of the vessel.



4. Add 1:1 methanol/water to the glass vessel until the hexapole assembly is immersed completely.
5. Place the vessel in the ultrasonic bath for 30 minutes.

Caution: To avoid recontaminating the hexapole assembly, wear clean, chemical-resistant, powder-free gloves for the rest of this procedure.

6. Carefully remove the hexapole assembly from the vessel, and blow-dry it using inert, oil-free gas.

7. Inspect the hexapole assembly for persisting contamination, If contamination is present, do as follows:

   a. Use the wash-bottle containing methanol to rinse the source hexapole assembly over the large beaker.

   b. Blow-dry the hexapole assembly with inert, oil-free gas.

8. Use the small flat-blade screwdriver to ensure that the hexapole assembly screws are tight.

Fitting the hexapole assembly, PEEK ion block support, and ion block assembly to the source assembly

Required materials:

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- Lint-free cloth
- HPLC-grade (or better) 1:1 methanol/water

To fit the hexapole assembly and PEEK ion block support to the source

Caution: To avoid recontaminating the source, wear clean, chemical-resistant, powder-free gloves during this procedure.

Caution: To avoid damage, when fitting the hexapole assembly into the adaptor housing, observe these precautions:

- Avoid scratching the internal surfaces of the adaptor block.
- Do not compress the hexapole rods.

1. Carefully fit the source hexapole assembly into the adaptor housing, aligning the notches in the differential aperture at its rear with the two bottom support rails on the analyzer assembly. Then carefully slide the assembly fully into place.

2. Ensure that the grooves for the PEEK ion block support O-rings are free from dirt and debris.

   Tip: If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.

3. Fit new O-rings to the PEEK ion block support.

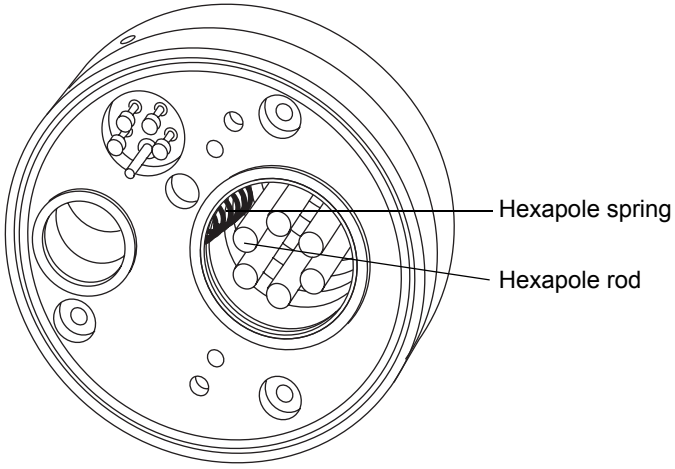
   Tip: To fit an O-ring in its groove, start fitting the O-ring at the notch in the groove and then progressively work the ring into the groove in either direction from the notch.

4. Fit the PEEK ion block support to the instrument's housing.

   Caution: To ensure correct operation of the instrument, neither hexapole spring must touch a hexapole rod.

5. Use the 3-mm Allen wrench to fit and tighten the 3 PEEK ion block support securing screws.

   Tip: Look through the PEEK ion block support as you tighten the securing screws. Ensure that neither hexapole spring buckles and touches a hexapole rod.



6. Fit the ion block assembly to the PEEK ion block support. See "Fitting the ion block assembly to the source assembly" on page 5-49.

Replacing the ESI probe tip

Replace the ESI probe tip if a blockage occurs in the internal metal sheathing through which the stainless steel capillary passes or if the probe tip threads are damaged.

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm (¼-inch) wrench

To replace the ESI probe tip

Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

Warning: The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

1. Remove the probe from the source. See also "Installing the corona pin" on page 3-5.
2. Use the 6-mm (¼-inch) wrench to unscrew and remove the probe tip.

   Warning: The probe tip can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

3. Dispose of the probe tip in accordance with local environmental regulations.
4. Use the 6-mm (¼-inch) wrench to fit and tighten the new probe tip to the probe.

5. Adjust the probe tip so that the fully extended capillary (when the probe nebulizer adjuster knob is fully screwed down) protrudes by approximately 1 to 1.5 mm.
6. Fit the probe to the source. See also "Installing the ESI probe" on page 3-2.

Replacing the ESI probe sample capillary

The stainless steel sample capillary in the ESI probe must be replaced if it becomes blocked and cannot be cleared, or if it becomes contaminated or damaged.

Required materials:

- Chemical-resistant, powder-free gloves
- 1.5-mm Allen wrench
- 6-mm (¼-inch) wrench
- 5/16-inch wrench
- 7/16-inch wrench
- Flat-blade screwdriver
- Needle-nose pliers
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile/water

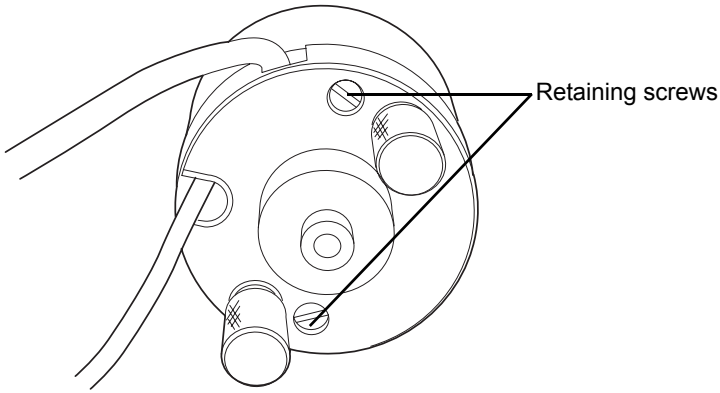
To replace the capillary

Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

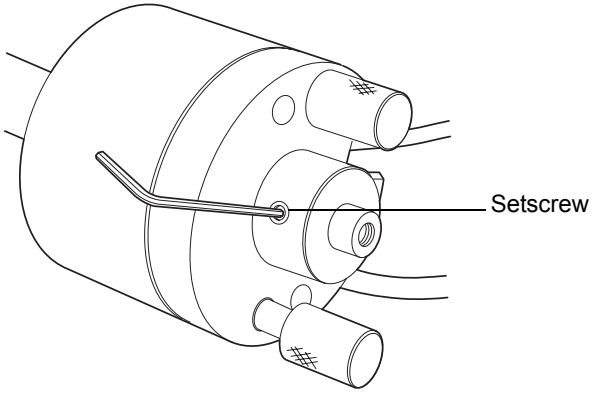
Warning: The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

Warning: The ESI probe tip is sharp. To avoid puncture wounds, handle the probe with care.

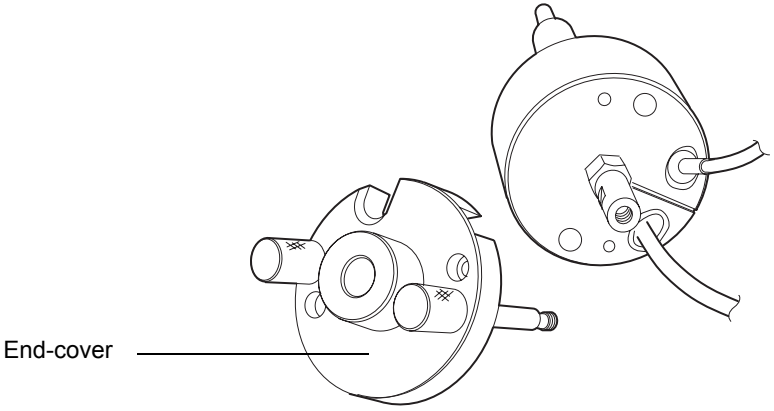
1. Remove the probe from the source. See "Installing the corona pin" on page 3-5.
2. Use the screwdriver to remove the 2 probe end-cover retaining screws.



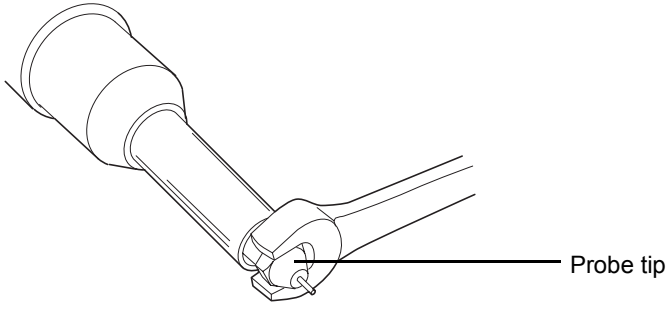
3. Use the 1.5-mm wrench to loosen the set screw on the LC PEEK union.



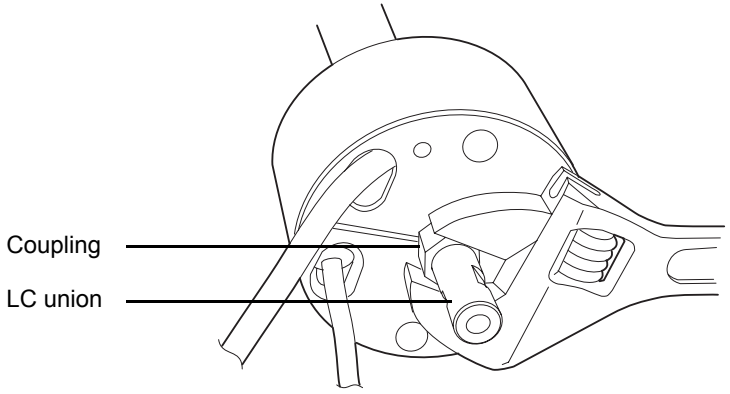
4. Remove the end-cover.



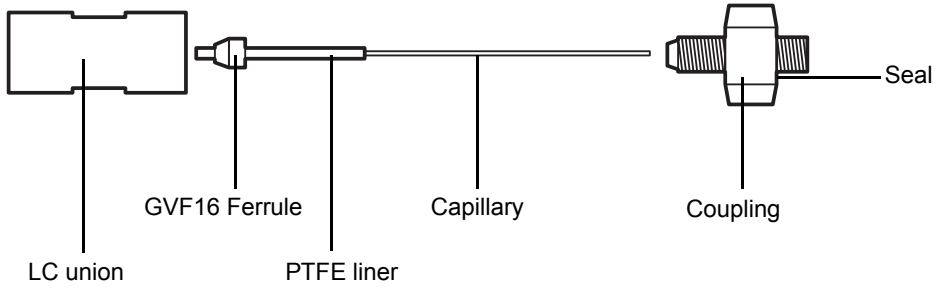
5. Use the 6-mm wrench to remove the probe tip.



6. Use the 5/16-inch and 7/16-inch wrenches to unscrew the coupling.



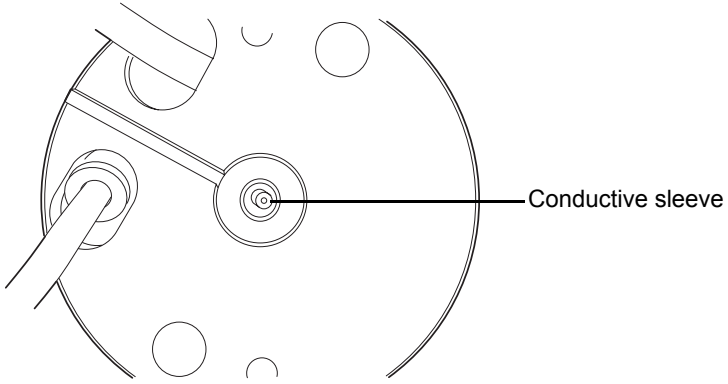
7. Withdraw the LC union, coupling and capillary from the probe.
8. Remove the LC union, capillary and seal from the coupling.



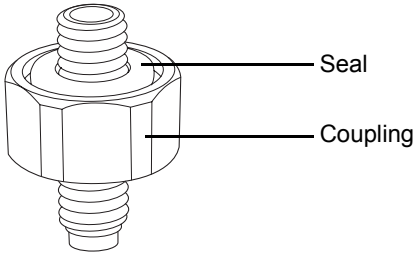
Warning: The capillary, PTFE liner, ferrule assembly, and seal can be contaminated with biohazardous and/or toxic materials. Ensure that they are correctly disposed of according to local environmental regulations.

9. Dispose of the capillary, PTFE liner, ferrule assembly, and seal in accordance with local environmental regulations.

10. Use the needle-nose pliers to remove the conductive sleeve from the inner bore of the probe assembly fitting.

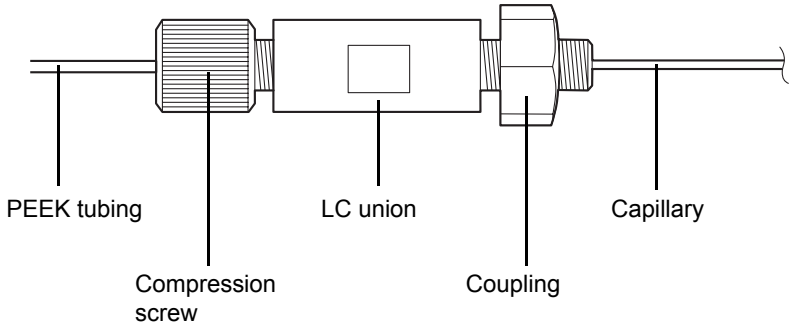


11. Slide a new GVF16 ferrule onto the PTFE liner tube.
12. Fit a new seal into the groove facing the short end of the coupling.

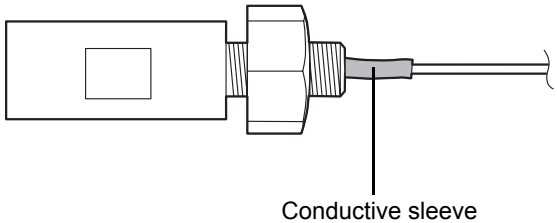


13. Slide the coupling—short end first—onto the capillary, followed by the new PTFE liner tube and ferrule and screw the coupling into the LC union.

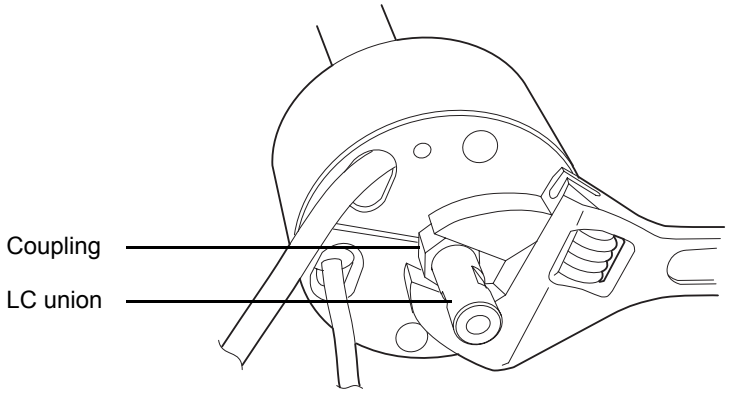
14. Slide a compression screw and ferrule onto a piece of 1/16 × 0.0025 bore (5M) PEEK tubing and connect the tubing to the opposite side of the LC union.



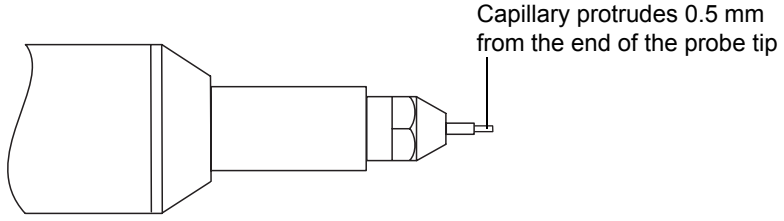
15. Push the capillary into the union until it seats.
16. Tighten the adaptor nut on the LC union so that it is snug but not tight.
17. Gently tug the capillary to make sure it remains secure.
18. Remove the PEEK tubing from the union.
19. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 1:1 acetonitrile/water through it at 1 mL/min.
20. If leakage occurs, disassemble and remake the connection, and then repeat the leak test.
21. When performing the leak test, check the backpressure on the LC pump, which will be relatively high if the capillary is blocked. If this is the case, replace the capillary.
22. When the leak test is performed successfully, disconnect the PEEK tubing from the LC pump.
23. Slide the conductive sleeve onto the capillary, and then feed the capillary through the probe.



24. Attach the coupling nut to the probe, and gently tighten it with the 7/16-inch wrench.



25. Replace the probe tip, and then screw down until the capillary protrudes approximately 0.5 mm from the end of the tip.



26. Fit the probe end-cover.
27. Fit and tighten the two probe end-cover retaining screws.
28. Tighten the set screw to clamp the LC union in place.
29. Attach the nebulizer gas connection to the probe.
30. Fit the probe to the instrument.

Cleaning the IonSABRE APCI probe tip

Clean the APCI probe tip when a buffer buildup is detected on the probe tip or when the signal intensity weakens.

To clean the APCI probe tip

1. Stop the liquid flow.
2. In the Tune window, click Gas 

to start the desolvation gas flow.
3. In the Source tab, set Desolvation to 650 L/hr.
4. Set APcI Probe Temp to 650 °C.
5. Click Operate  .
6. Wait 10 minutes.

   Rationale: The high APCI probe heater temperature removes any chemical contamination from the probe tip.

Replacing the IonSABRE APCI probe sample capillary

Replace the stainless steel sample capillary in the APCI probe if it becomes blocked and you cannot clear it, or if it becomes contaminated or damaged.

Removing the existing capillary

Required materials:

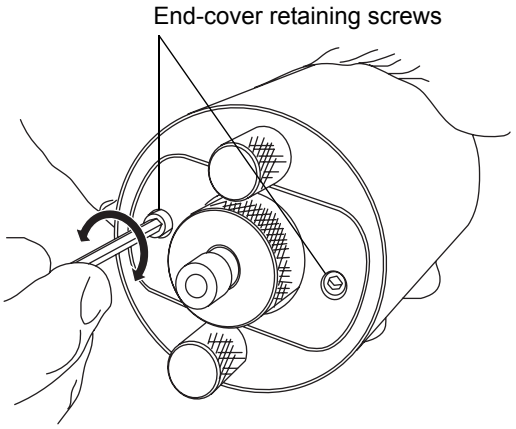
- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 7-mm wrench
- 2.5-mm Allen wrench

To remove the existing capillary

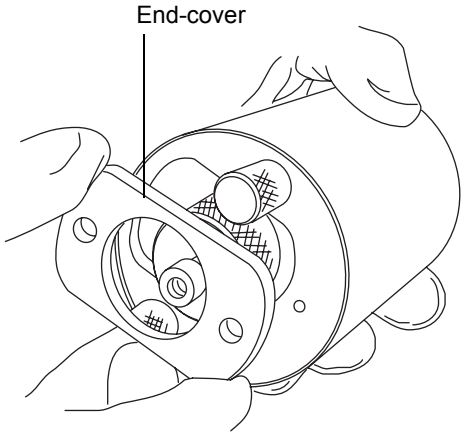
Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

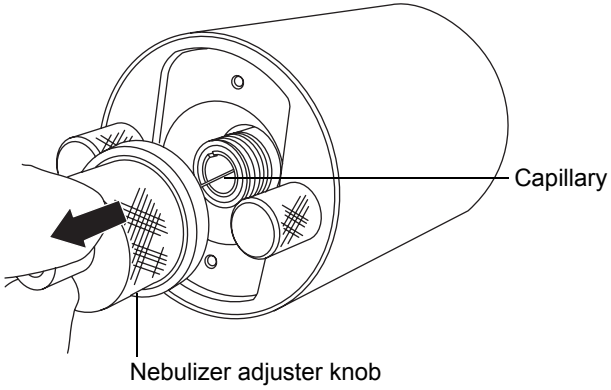
1. Remove the probe from the source. See "Removing the IonSABRE APCI probe" on page 6-7.
2. Use the 2.5-mm Allen wrench to remove the 2 probe end-cover retaining screws.



3. Remove the end-cover.

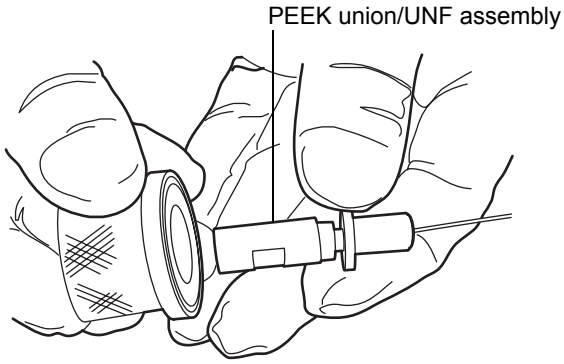


4. Unscrew and remove the nebulizer adjuster knob to reveal a PEEK union/UNF coupling assembly and the capillary.

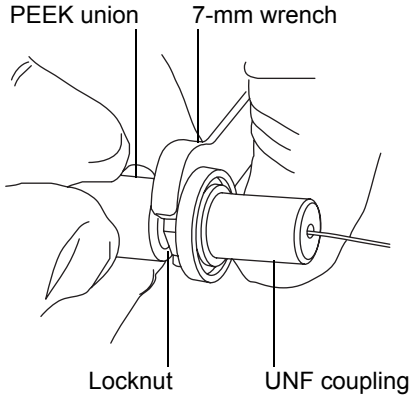


5. Remove the nebulizer adjuster knob, PEEK union/UNF coupling assembly, and capillary from the probe.

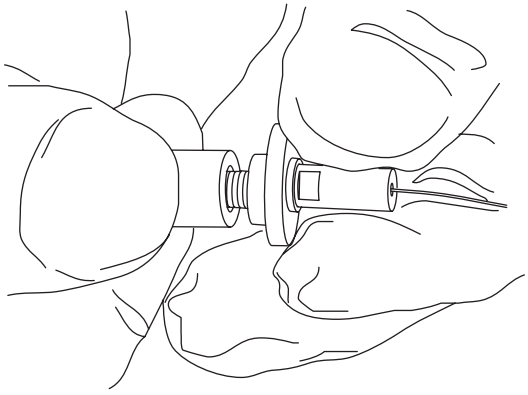
6. Remove the PEEK union/UNF coupling assembly and capillary from the nebulizer adjuster knob.



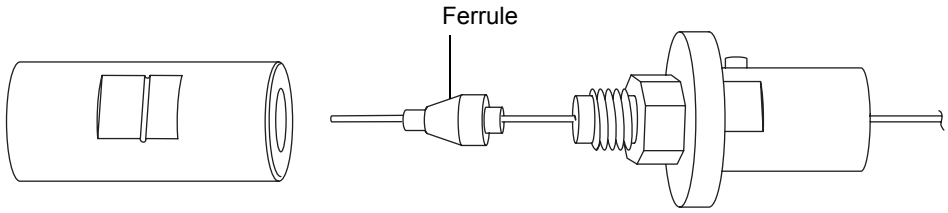
7. Use the 7-mm wrench to loosen the locknut securing the PEEK union and UNF coupling.



8. Unscrew the PEEK union from the UNF coupling. This connection is finger-tight only.



9. Remove the ferrule from the capillary.



10. Remove the capillary from the UNF coupling.

Installing the new capillary

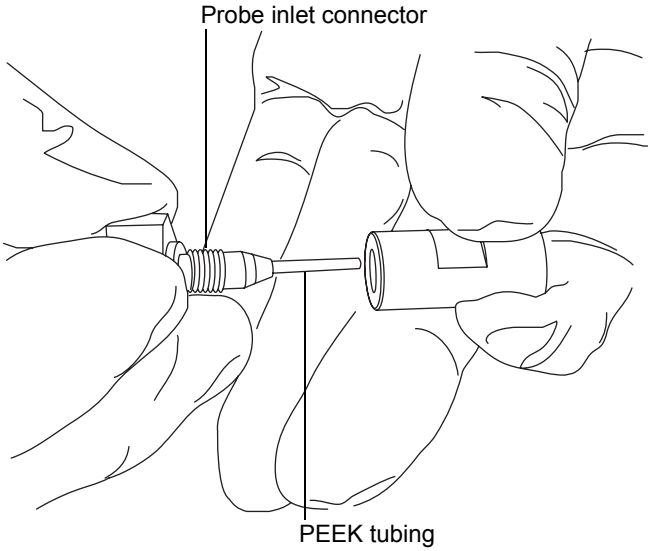
Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 7-mm wrench
- 2.5-mm Allen wrench
- Length of red PEEK tubing
- LC pump
- HPLC-grade (or better) 1:1 acetonitrile/water

To install the new capillary

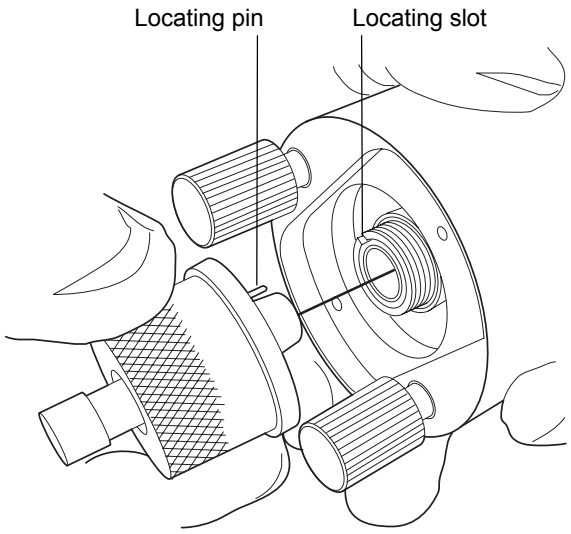
Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Insert a square-cut length of red PEEK tubing in the probe inlet connector, and screw the connector, finger-tight, into the PEEK union. This step ensures a minimum dead volume when fitting the capillary.



2. Fit the UNF coupling to the new capillary.
3. Use the needle-nose pliers to slide a new ferrule onto the capillary.
4. Insert the capillary in the PEEK union, and ensure that it is fully seated.
5. Screw the UNF coupling into the PEEK union, finger-tight only.
6. Pull on the capillary gently, testing to ensure that it stays in place.
7. Use the 7-mm wrench to tighten the locknut against the PEEK union.
8. Check for leaks in the assembly by attaching the free end of the PEEK tubing to an LC pump and pumping 1:1 acetonitrile/water at 1 mL/min.

9. If leakage occurs, disassemble and remake the connection, and repeat the leak test.
10. When performing the leak test, check the backpressure on the LC pump, which will be high if the capillary is blocked. If this is the case, replace the capillary.
11. When the leak test has been performed successfully, disconnect the PEEK tubing from the LC pump.
12. Remove the probe inlet connector and PEEK tubing from the PEEK union.
13. Remove the probe heater. See "Replacing the APCI probe heater" on page 5-74, step 2 through step 4.
14. Fit the PEEK union/UNF coupling assembly to the nebulizer adjuster knob.
15. Carefully thread the capillary through the probe assembly.
16. Depress the PEEK union so that the locating pin on the UNF coupling is fully engaged in the locating slot at the head of the probe assembly. When the union is fully depressed, tighten the nebulizer adjuster knob. Do not tighten the knob fully.



17. Fit the probe end-cover to the probe assembly.

18. Use the 2.5-mm Allen wrench to fit and tighten the 2 end-cover securing screws.

Caution:

- When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.
- Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.

19. Fit the probe heater. See "Replacing the APCI probe heater" on page 5-74, step 5 through step 8.
20. Fit the probe to the instrument. See "Installing the IonSABRE APCI probe" on page 6-3.
21. In the console, click API  to start the desolvation gas flow.
22. Use the probe adjuster knob to adjust the capillary so that the capillary protrudes approximately 0.5 mm from the end of the probe.

Cleaning or replacing the corona pin

Required materials:

- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- HPLC-grade (or better) methanol
- Lint-free tissue

To clean or replace the corona pin

Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: The probe and source can be hot. To avoid burn injuries, take great care while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is in Standby mode before commencing this procedure.

Warning: The corona pin tip is sharp. To avoid puncture wounds, handle the corona pin with care.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

1. Remove the corona pin from the source. See "Removing the corona pin" on page 3-9.
2. Replace the pin if it is deformed or otherwise damaged. Otherwise clean the tip of the pin with the lapping film, and then wipe it clean with a methanol-saturated tissue.
3. Install the corona pin in the source. See "Installing the corona pin" on page 3-5.

Replacing the APCI probe heater

Replace the APCI probe heater if it fails to heat.

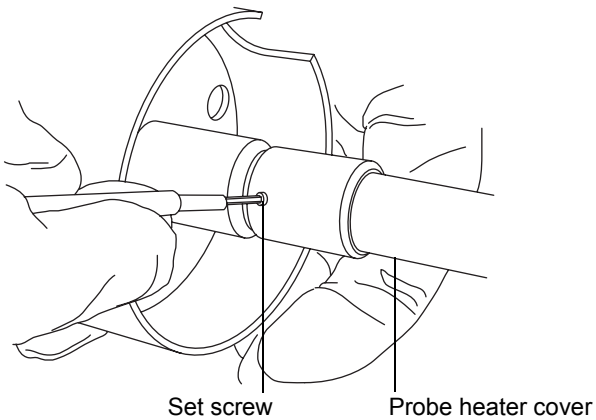
Required materials:

- Chemical-resistant, powder-free gloves
- Flat-blade jeweler's screwdriver

To replace the APCI probe heater

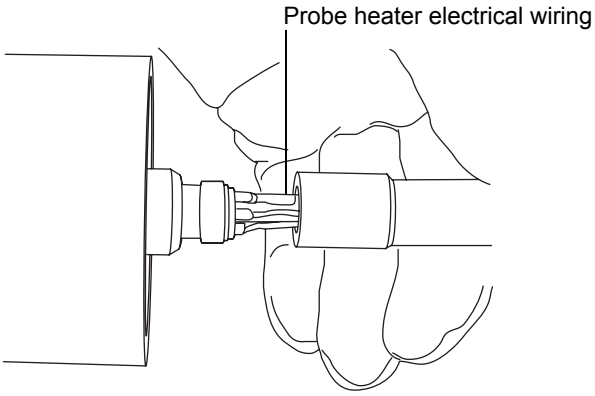
Warning: The probe and source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the probe from the source. See "Removing the IonSABRE APCI probe" on page 6-7.
2. Use the jeweler's screwdriver to loosen the 2 set screws securing the probe heater cover to the probe.



Caution: Take great care not to damage the probe heater's electrical wiring when removing the probe heater cover or while the probe heater is exposed.

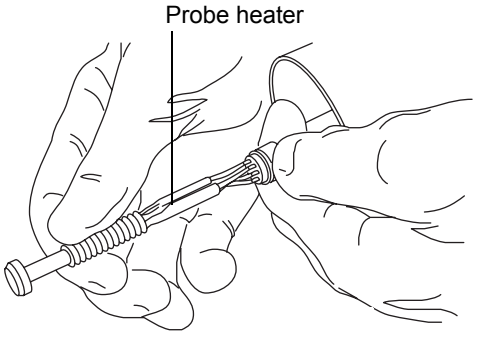
3. Carefully pull the probe heater cover off the probe, revealing the probe heater.



Caution:

- When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.
- To avoid damaging the probe heater's electrical connections, do not twist the heater when removing it from the probe assembly.

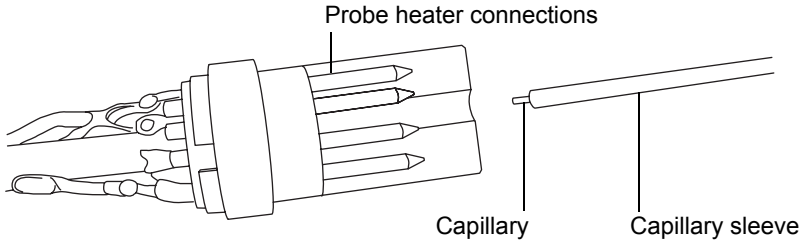
4. Gripping the probe heater as shown, carefully pull it off the probe assembly.



Caution:

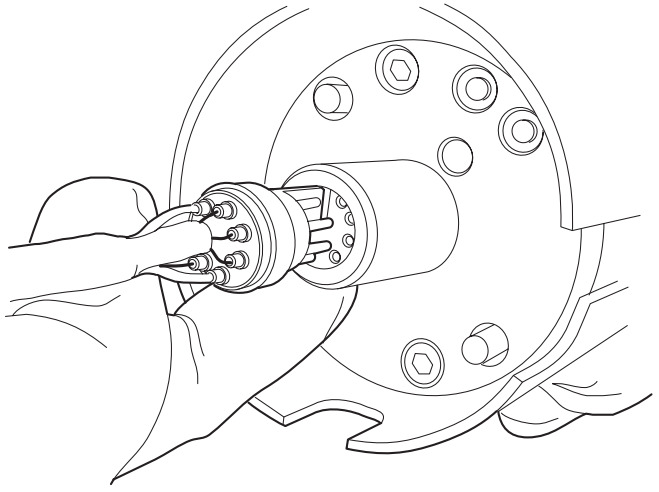
- When handling the probe heater, take great care to grip the heater so as not to damage its electrical wiring.
- Take great care not to damage the probe heater's electrical connections, capillary sleeve, or capillary when fitting the heater over the capillary sleeve.

5. Carefully slide the probe heater over the capillary sleeve on the probe assembly.



Caution: To avoid damaging the probe heater's electrical connections, do not twist the heater when fitting it to the probe assembly.

6. Fit the probe heater to the probe assembly, ensuring that the heater is fully seated on the probe assembly.



7. Fit the probe heater cover to the probe assembly.
8. Use the jeweler's screwdriver to tighten the 2 set screws securing the probe heater cover to the probe.
9. Fit the probe to the instrument. See "Installing the IonSABRE APCI probe" on page 6-3.
10. In the console, click API  to start the desolvation gas flow.
11. Use the probe adjuster knob to adjust the capillary so that the capillary protrudes approximately 0.5 mm from the end of the probe.

Replacing the ion block source heater

Replace the ion block source heater if it fails to heat when the instrument is pumped down (evacuated).

Required materials:

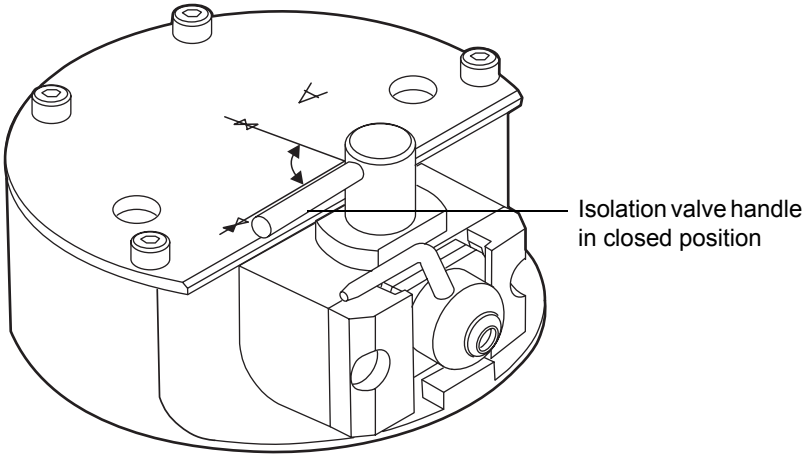
- Chemical-resistant, powder-free gloves
- Needle-nose pliers
- 1.5-mm and 2.5-mm Allen wrenches

To replace the ion block source heater

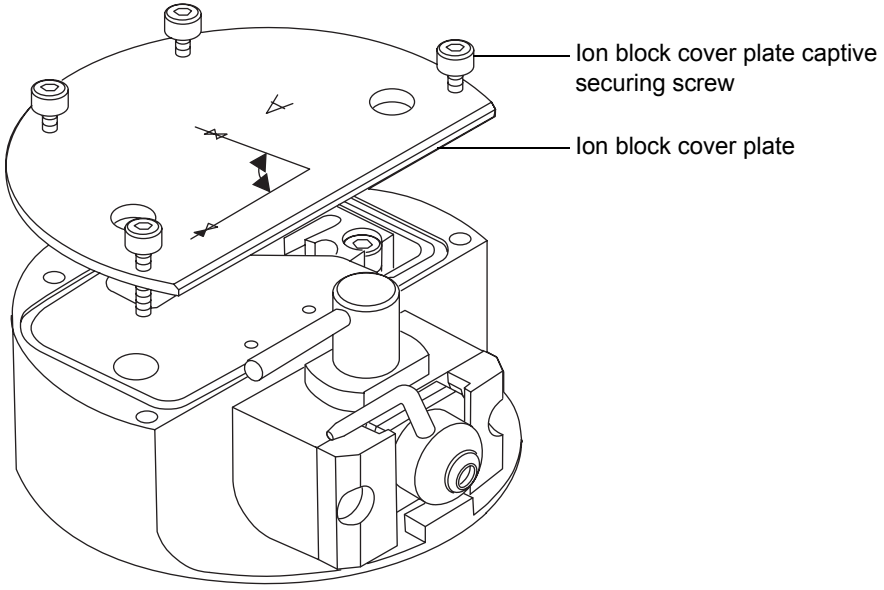
Warning: The ion block assembly can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Remove the ion block assembly from the instrument. See "Removing the ion block assembly from the source assembly" on page 5-35.

2. Ensure that the isolation valve is closed.

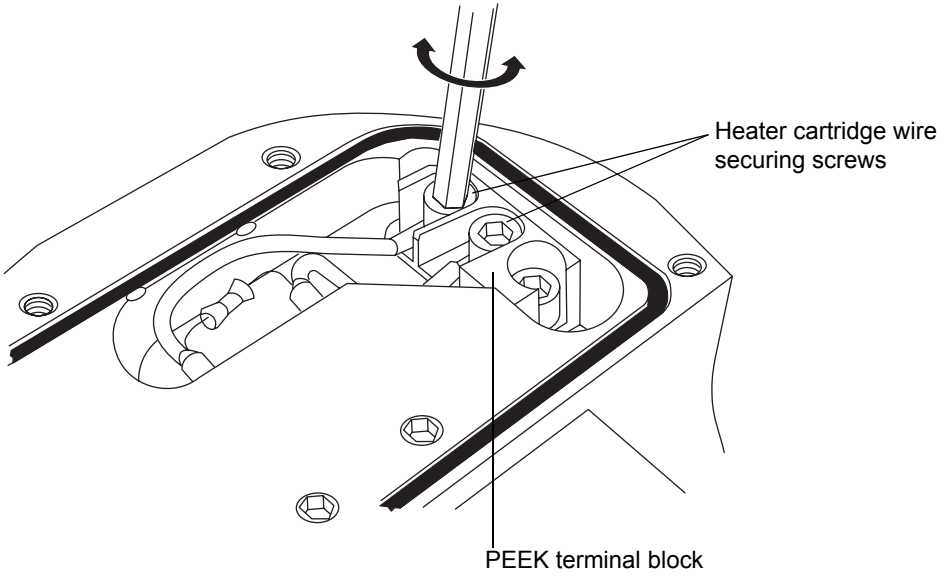


3. Use the 2.5-mm Allen wrench to loosen the 4 captive screws securing the ion block cover plate.

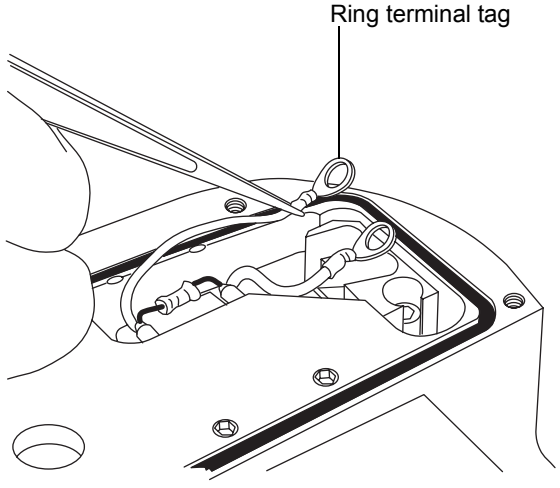


4. Remove the ion block cover plate.

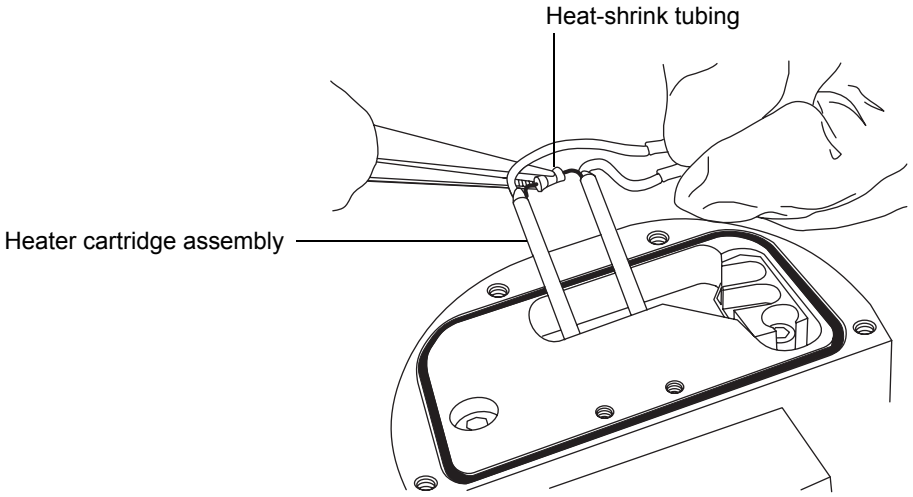
5. Use the 1.5-mm Allen wrench to remove the 2 screws securing the heater wires to the PEEK terminal block.



6. Use the needle-nose pliers to carefully swing the ring terminal tags out of the terminal block.



7. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the heater cartridge assembly and slide the assembly out of the ion block.



8. Dispose of the heater cartridge assembly.

Caution: To avoid damaging the heater cartridge assembly wires, do not bend or twist them either side of the heater cartridge assembly heat-shrink tubing when fitting the assembly to the ion block.

9. Use the needle-nose pliers to gently grasp the heat-shrink tubing on the new heater cartridge assembly and slide the assembly into the ion block..

Caution: To avoid a short circuit to the ion block cover, ensure that the two heater cartridge ring tags are pushed fully down on the PEEK block terminals.

10. Use the needle-nose pliers to position the 2 heater wire ring tags fully down on the PEEK block terminals.
11. Use the 1.5-mm Allen wrench to fit and tighten the 2 screws securing the heater wires to the PEEK terminal block.
12. Fit the ion block cover plate to the ion block assembly, and then use the 2.5-mm Allen wrench to tighten the 4 captive screws securing ion block cover plate.

13. Fit the ion block assembly to the instrument. See “Fitting the ion block assembly to the source assembly” on page 5-49.

Replacing the source assembly seals

Warning: To avoid possible excessive leakage of solvent vapor into the laboratory atmosphere, the seals listed below must be renewed, at intervals of no greater than 1 year, exactly as described in this section.

To avoid possible excessive leakage of solvent vapor into the laboratory atmosphere, the following seals must be renewed at intervals of no greater than 1 year:

- Source enclosure door seal
- Source enclosure door glass seal
- Source enclosure housing seal
- Source enclosure side flange seal
- Probe adjuster assembly probe seal
- Probe adjuster assembly flange seal

To complete this procedure, you must pressure test the source, as described in the *Waters Micromass Source Pressure Test Unit Operator’s Guide*.

Removing the source enclosure from the instrument

Required materials:

- Chemical-resistant, powder-free gloves
- 5-mm Allen wrench

To remove the source enclosure

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Vent and shut-down the detector. See "Shutting down the detector" on page 2-12.

   Warning: The source can be hot. To avoid burn injuries, allow it to cool for at least 30 minutes before proceeding.

2. Remove the probe from the source.
   - If you are removing an ESI probe, see "Installing the corona pin" on page 3-5.
   - If you are removing an IonSABRE APCI probe, see "Removing the IonSABRE APCI probe" on page 6-7.

   Caution: Do not apply any downward force to the source enclosure door while the door is open.

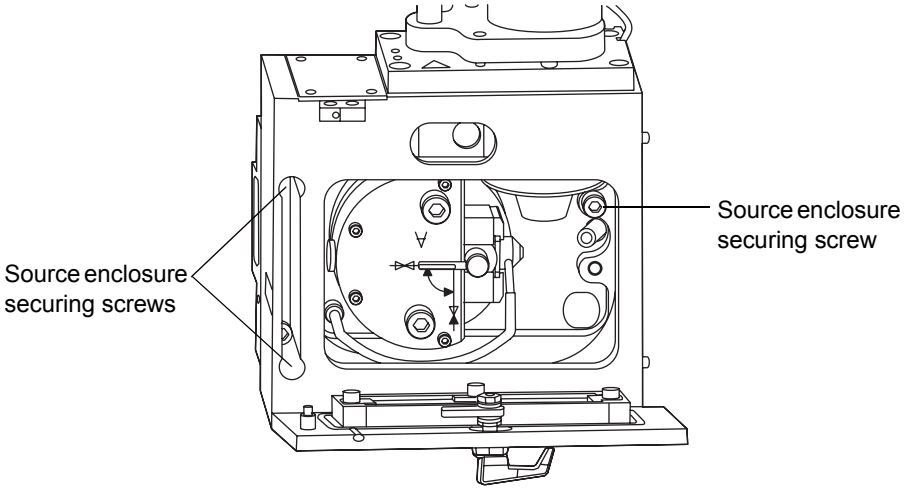
3. Unfasten the source enclosure door's handle and open the door.

   Warning: The corona pin tip is sharp. To avoid puncture wounds, handle the corona pin with care.

4. If using ESCi mode or an IonSABRE APCI probe, carefully remove the corona pin. See "Removing the corona pin" on page 3-9.
5. Disconnect the probe's electrical connection at the instrument's front panel.
6. Disconnect the PTFE tubing at the desolvation gas connection on the front panel.
7. Disconnect the 2-pin connector at the rear of the source enclosure.

8. Use the 5-mm Allen wrench to loosen the 3 captive source enclosure securing screws.



Caution: Do not apply any downward force to the source enclosure door when removing the source enclosure from the instrument's housing.

9. Remove the source enclosure from the instrument.

Disassembling the source enclosure and probe adjuster assembly

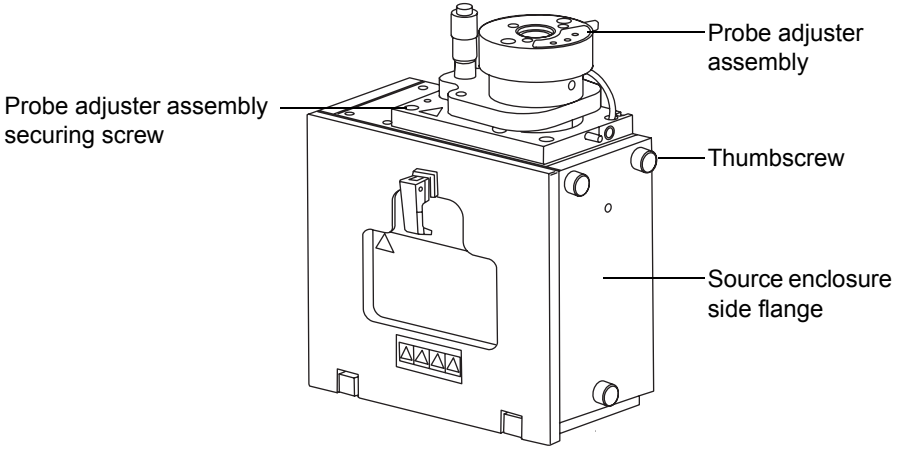
Required materials:

- Chemical-resistant, powder-free gloves
- 4-mm Allen wrench

To dismantle the source enclosure and probe adjuster assembly

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Use the 4-mm Allen wrench to remove the 4 screws securing the probe adjuster assembly to the source enclosure.



2. Remove the probe adjuster assembly from the source enclosure.
3. Unscrew and remove the 3 thumbscrews that secure the source enclosure side flange to the source enclosure.
4. Remove the source enclosure side flange from the source enclosure.

Removing the seals from the source enclosure and probe adjuster assembly

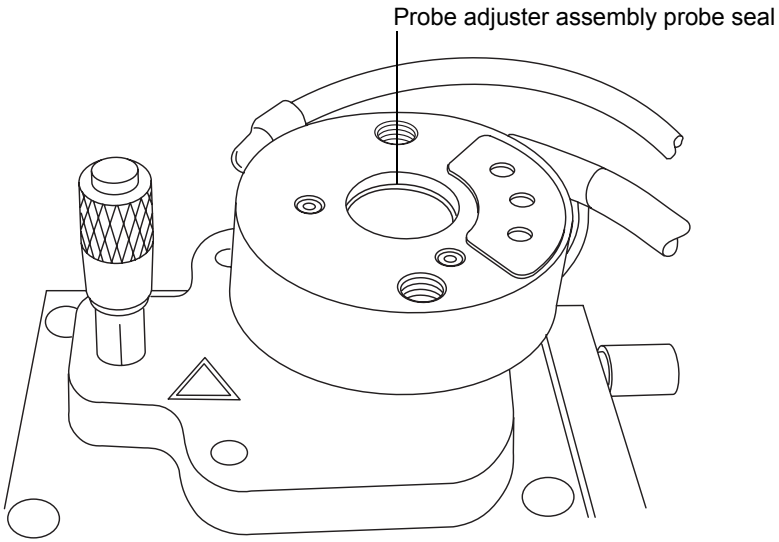
Required materials:

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- O-ring removal kit

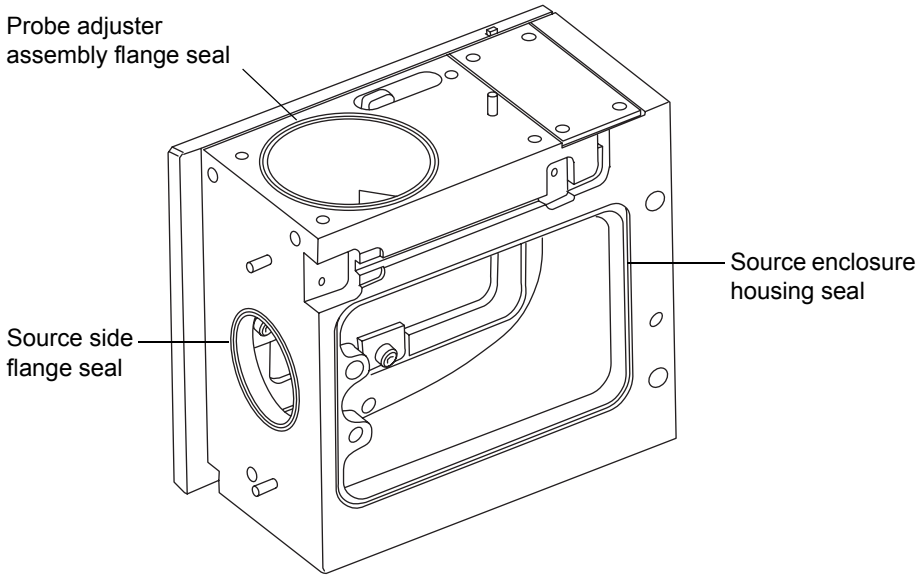
To remove the seals from the source enclosure and probe adjuster assembly

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Use the O-ring removal kit to carefully remove the probe adjuster assembly probe seal from the probe adjuster assembly. See "Removing O-rings and seals" on page 5-9.



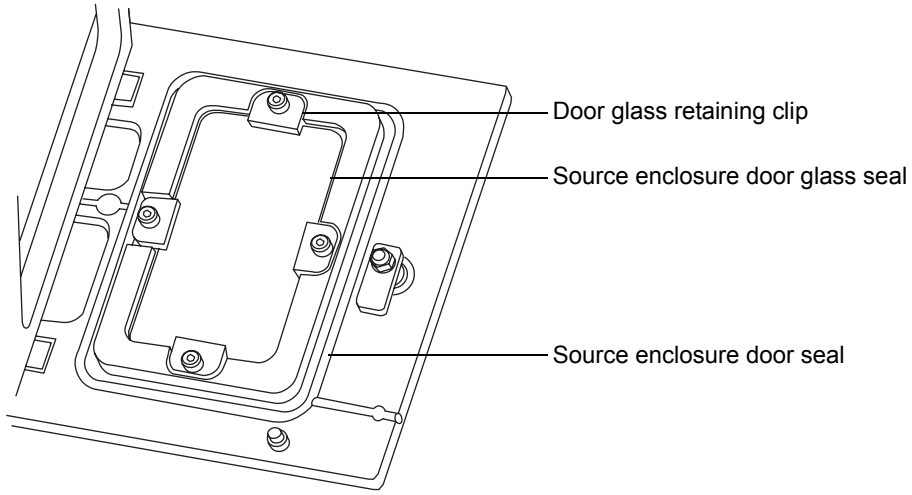
2. Use the O-ring removal kit to carefully remove the following seals from the source enclosure:
   - Source enclosure housing seal
   - Source enclosure side flange seal
   - Probe adjuster assembly flange seal



Caution: Do not apply any downward force to the source enclosure door while the door is open.

3. Unlatch the source enclosure door handle by pulling it upward to the horizontal position and then rotating it 90 degrees clockwise and open the door.

4. Use the O-ring removal kit to carefully remove the seal from the source enclosure door.



5. Use the 3-mm Allen wrench to remove the 4 bolts securing the glass-retaining clips to the source enclosure door.
6. Remove the 4 glass-retaining clips from the source enclosure door.
7. Remove the glass from the source enclosure door.
8. Use the O-ring removal kit to carefully remove the door glass seal from the source enclosure door.

Warning: The seals can be contaminated with biohazardous and/or toxic materials. Ensure that they are correctly disposed of according to local environmental regulations.

9. Dispose of all the seals in accordance with local environmental regulations.

Fitting the new source enclosure and probe adjuster assembly seals

Required materials:

- Chemical-resistant, powder-free gloves
- 3-mm Allen wrench
- Wash bottle containing HPLC-grade (or better) 1:1 methanol/water

To fit the new source enclosure and probe seals

Warning: The source components can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Caution: Do not apply any downward force to the source enclosure door while the door is open.

1. Ensure that all the grooves for seals are free from dirt and debris.

   Tip: If contamination is present, use 1:1 methanol/water, applied to a lint-free cloth, to carefully clean the grooves.

2. Fit the new door glass seal to the source enclosure door.
3. Fit the glass to the source enclosure door.
4. Fit the 4 glass retaining clips to the source enclosure door.

   Caution: The 4 bolts securing the glass retaining clips must each be sequentially and incrementally tightened until they are all fully tight.

5. Use the 3-mm Allen wrench to fit and tighten the 4 bolts securing the glass retaining clips to the source enclosure door.

   Caution: Ensure that the tails of the source enclosure door seals are correctly located in the groove when fitting them to the source enclosure door.

6. Fit the new source enclosure door seal to the source enclosure door.

7. Close the source enclosure door and fasten the handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
8. Fit the following new seals to the source enclosure:
   - Source enclosure housing seal
   - Source enclosure side flange seal
   - Probe adjuster assembly flange seal
9. Fit the new probe adjuster assembly probe seal to the probe adjuster assembly.

Assembling the probe adjuster assembly and source enclosure

Required materials:

- Chemical-resistant, powder-free gloves
- 4-mm Allen wrench

To assemble the probe adjuster assembly and source enclosure

1. Fit the source enclosure side flange to the source enclosure.

   Caution: The source enclosure side flange securing thumbscrews must each be sequentially and incrementally tightened until they are all fully tight.

2. Fit and tighten the 3 thumbscrews that secure the source enclosure side flange to the source enclosure.
3. Fit the probe adjuster assembly to the source enclosure.

   Caution: The probe adjuster assembly securing screws must each be sequentially and incrementally tightened until they are all fully tight.

4. Use the 4-mm Allen wrench to fit and tighten the 4 screws securing the probe adjuster assembly to the source enclosure.

Fitting the source enclosure to the instrument

Required materials:

- Chemical-resistant, powder-free gloves
- 5-mm Allen wrench

To fit the source enclosure to the instrument

Warning: To confirm the integrity of the source exhaust system, perform the procedure exactly as described in this section.

Caution:

- To avoid recontaminating the source, wear clean, chemical-resistant, powder-free gloves during this procedure.
- Do not apply any downward force to the source enclosure door when fitting the source enclosure to the instrument's housing.

1. Ensuring that the wires to the microswitch do not become trapped between the source enclosure and the instrument's housing, fit the source enclosure to the housing.

   Caution: The source enclosure securing screws must each be sequentially and incrementally tightened until they are all fully tight.

2. Use the 5-mm Allen wrench to tighten the 3 captive screws securing the source enclosure.
3. Connect the 2-pin connector at the rear of the source enclosure.
4. Connect the PTFE tubing to the desolvation gas connection at the instrument's front panel
5. Connect the probe's electrical connection at the instrument's front panel.

   Warning: The corona pin tip is sharp. To avoid puncture wounds, handle the corona pin with care.

6. If using ESCi mode or an IonSABRE APCI probe, carefully fit the corona pin. See "Installing the corona pin" on page 3-5.

7. Close the source enclosure door and fasten the door's handle by rotating it 90 degrees counterclockwise to the vertical position and then pushing it downward.
8. Fit the probe to the source.
   - If you are fitting an ESI probe, see "Installing the ESI probe" on page 3-2.
   - If you are fitting an IonSABRE APCI probe, see "Installing the IonSABRE APCI probe" on page 6-3.
9. Start the detector. See "Starting the detector" on page 2-2.

Warning: To confirm the integrity of the source exhaust system, a source pressure test must be performed, as described in the *Waters Micromass Source Pressure Test Unit Operator's Guide*.

10. Perform a source pressure test, as described in the *Waters Micromass Source Pressure Test Unit Operator's Guide*.

Maintaining the detector air filters

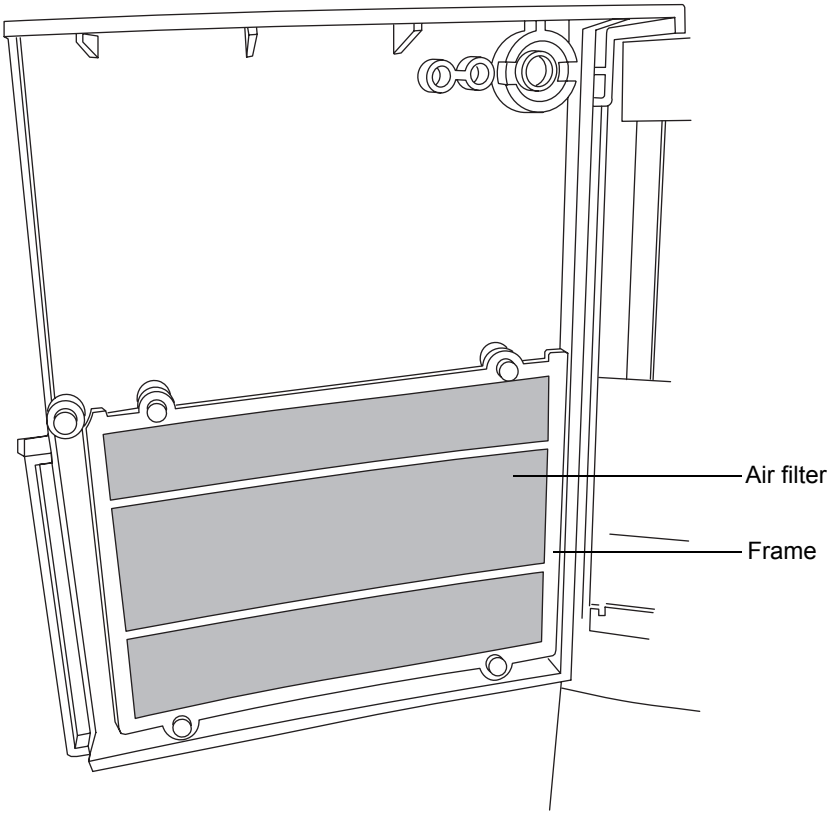
Cleaning the air filter inside the instrument's door

Required material: Vacuum cleaner

To clean the air filter inside the instrument's door

Use a vacuum cleaner to clean the air filter located inside the instrument's door.

Air filter inside the instrument's door



Replacing the air filter inside the instrument's door

If you cannot clean the air filter by vacuuming, replace it with a new filter.

Required materials:

- T10 TORX® driver
- 3100 detector door air filters

To replace the air filter inside the instrument's door

1. Use the T10 TORX driver to remove the 4 screws that secure the air filter frame and air filter to the inside of the instrument's door. See the figure "Air filter inside the instrument's door" on page 5-92.

2. Remove the air filter from the air filter frame and dispose of it.
3. Align the new air filter within the air filter frame.
4. Use the T10 TORX driver to fit and tighten the 4 screws securing the air filter and frame to the inside of the instrument's door.

Cleaning the air filter inside the instrument's lower bezel

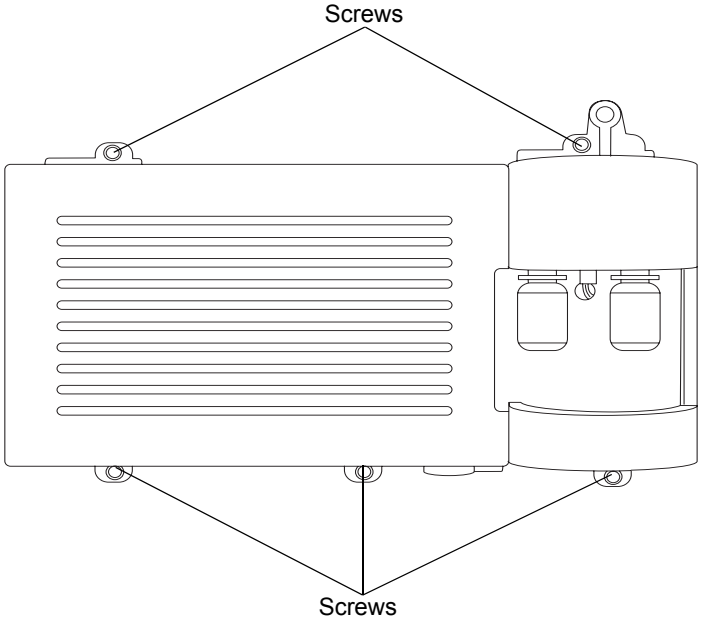
Required materials:

- T10 TORX driver
- Vacuum cleaner

To clean the air filter inside the instrument's lower bezel

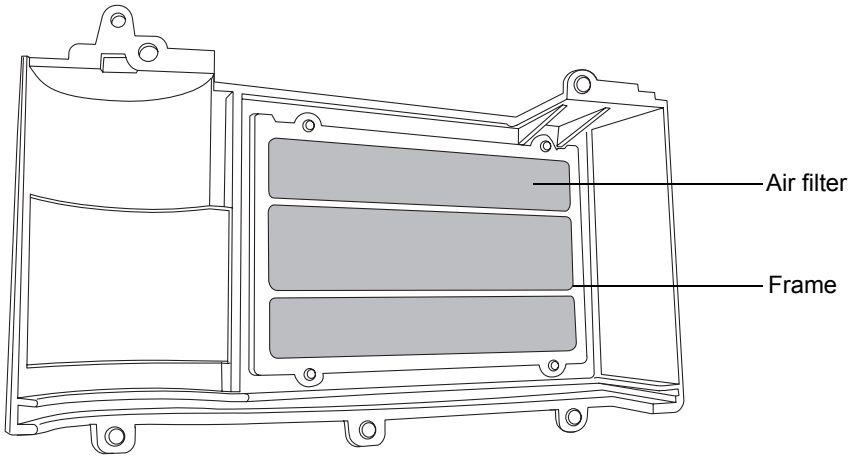
1. Use the T10 TORX driver to remove the 5 screws that secure the lower bezel in place.

Instrument's lower bezel



2. Use a vacuum cleaner to clean the air filter located inside the instrument's lower bezel.

Air filter inside the instrument's lower bezel



3. Reinstall the lower bezel.

Replacing the air filter inside the lower bezel

If you cannot clean the air filter by vacuuming, replace it with a new filter.

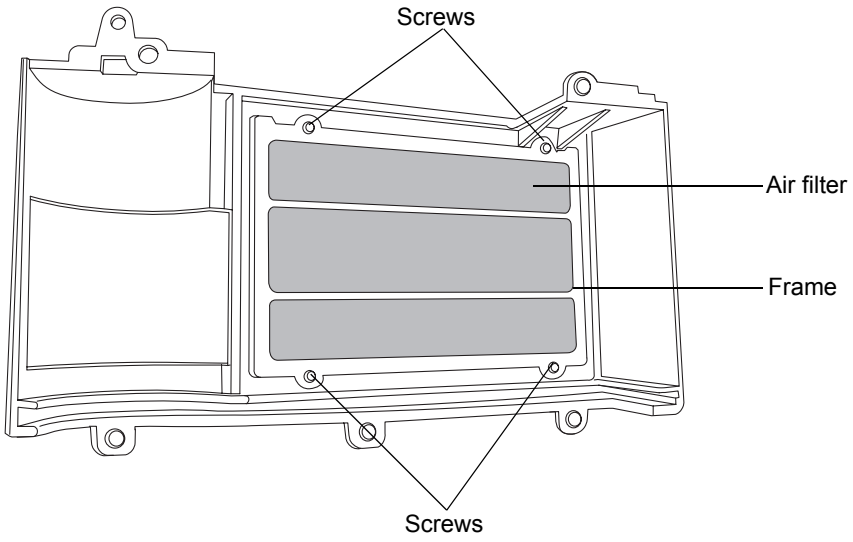
Required materials:

- T10 TORX driver
- 3100 detector lower bezel air filter

To replace the air filter inside the lower bezel

1. Remove the 5 screws that secure the lower bezel in place. See the figure "Instrument's lower bezel" on page 5-93.
2. Use the T10 TORX driver to remove the 4 screws that secure the air filter frame and air filter to the inside of the lower bezel.

Air filter inside the lower bezel



3. Remove the air filter from the air filter frame and dispose of it.
4. Align the new air filter within the air filter frame.
5. Use the T10 TORX driver to fit and tighten the 4 screws securing the air filter and frame to the inside of the lower bezel.
6. Reinstall the lower bezel.

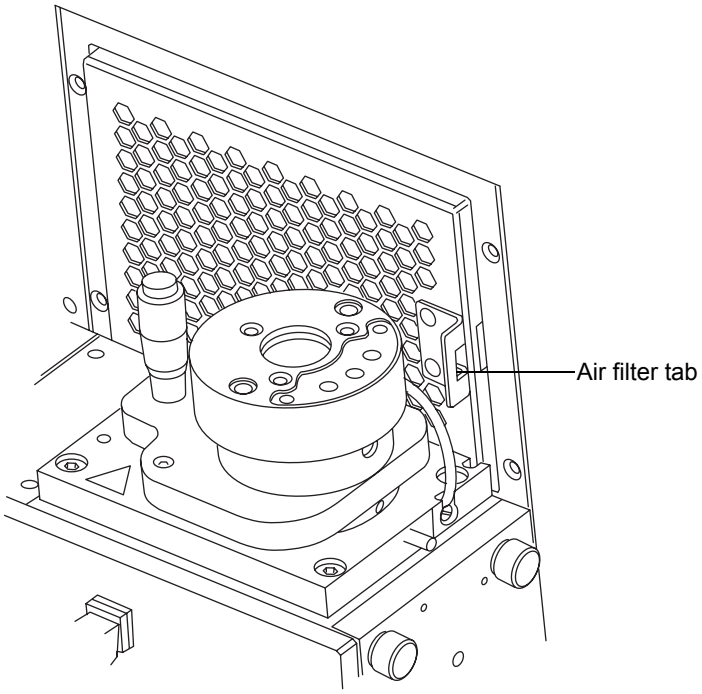
Cleaning the air filter behind the source probe

Required material: Vacuum cleaner

To clean the air filter behind the source probe

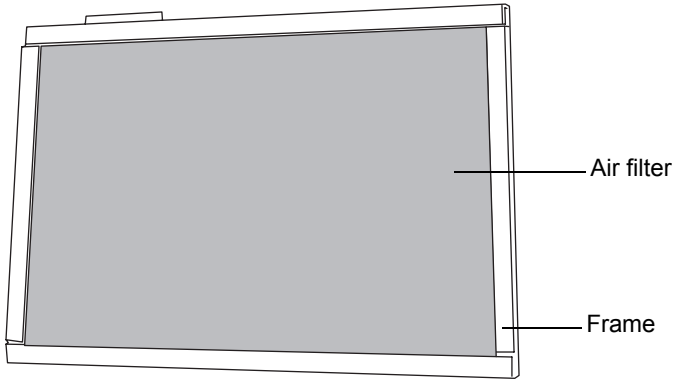
1. Remove the probe from the source.
   - If you are removing an ESI probe, see "Installing the corona pin" on page 3-5.
   - If you are removing an IonSABRE APCI probe, see "Removing the IonSABRE APCI probe" on page 6-7.
2. Grasp the air filter tab, and remove the air filter frame by lifting it toward you.

Air filter tab



3. Use a vacuum cleaner to clean the air filter.

Air filter removed from behind the source probe



4. Reinstall the air filter.
5. Fit the probe to the source.

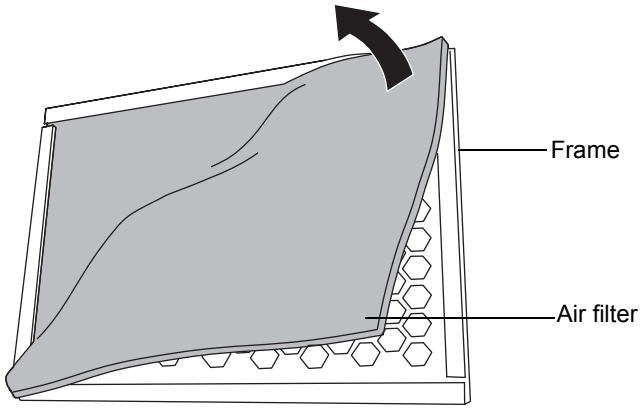
- If you are fitting an ESI probe, see “Installing the ESI probe” on page 3-2.
- If you are fitting an IonSABRE APCI probe, see “Installing the IonSABRE APCI probe” on page 6-3.

Replacing the air filter behind the source probe

To replace the air filter behind the source probe

1. Remove the probe from the source.
   - If you are removing an ESI probe, see “Installing the corona pin” on page 3-5.
   - If you are removing an IonSABRE APCI probe, see “Removing the IonSABRE APCI probe” on page 6-7.
2. Grasp the air filter tab and remove the air filter frame by lifting it toward you. See the figure “Air filter tab” on page 5-96.
3. Remove the air filter from the air filter frame and dispose of it.

Removing air filter from frame



4. Insert the new air filter in the air filter frame.
5. Reinstall the air filter.
6. Fit the probe to the source.

- If you are fitting an ESI probe, see “Installing the ESI probe” on page 3-2.
- If you are fitting an IonSABRE APCI probe, see “Installing the IonSABRE APCI probe” on page 6-3.

Replacing the roughing pump oil

Change the roughing pump oil annually.

Note: This procedure is not required for an Alcatel oil-free roughing pump.

Required materials:

- Chemical-resistant, powder-free gloves
- 8-mm Allen wrench
- Flat-blade screwdriver
- Container to catch used oil
- Funnel
- 1-L container of Anderol vacuum oil, type GS 495

To replace the roughing pump oil

1. Gas ballast the roughing pump for 1 hour to reduce the oil viscosity.

   Rationale: Gas ballasting helps to circulate and mix the oil through the pump before draining.

   See “Gas ballasting the roughing pump” on page 5-20.

2. Vent and shut-down the detector. See “Shutting down the detector” on page 2-12.

3. Allow the roughing pump to cool.

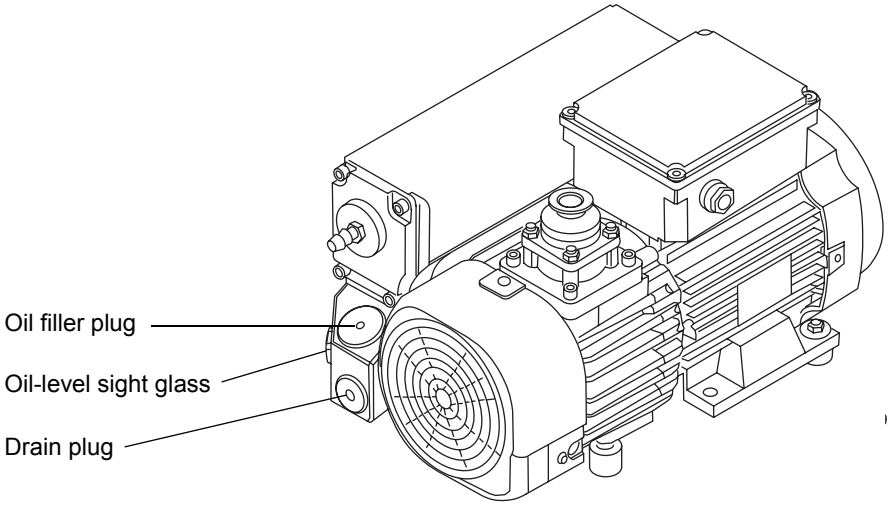
   Warning: The roughing pump oil can be contaminated with analyte accumulated during normal operation. Always wear chemical-resistant, powder-free gloves when adding or replacing oil.

   Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

4. Place the container for used oil under the pump’s drain plug.

5. Use the 8-mm Allen wrench to remove the oil filler plug.



6. Use the 8-mm Allen wrench to remove the oil drain plug.
7. Tip the pump toward the drain plug aperture and allow the oil to drain completely into the container.

Warning: The roughing pump oil can be contaminated with biohazardous and/or toxic materials. Ensure that they are correctly disposed of according to local environmental regulations.

8. Dispose of the roughing pump oil in accordance with local environmental regulations.
9. Ensure that the O-ring on the oil drain plug is clean and properly seated.

Caution: Observe these precautions to avoid oil leakage when fitting the oil drain plug to the roughing pump:

- Ensure that the plug is not cross-threaded.
- Ensure that the O-ring is not pinched.
- Do not overtighten the plug.

10. Use the 8-mm Allen wrench to fit and tighten the roughing pump's oil drain plug.

    Tip: When the oil drain plug is tightened, the plug seals with an O-ring. Compression is controlled by the O-ring groove depth in the plug. Increased torque does not improve the plug seal; it only makes the plug difficult to remove later.

    Caution: To maintain pump performance, use Anderol vacuum oil, type GS 495.

11. Using the funnel, pour all the oil from the 1-L container into the oil filler aperture.
12. Wait a few minutes, and then recheck the oil level.
13. Ensure that the O-ring on the oil filler plug is clean and properly seated.

    Caution: Observe these precautions to avoid oil leakage when fitting the oil filler plug to the roughing pump:

    - Ensure that the plug is not cross-threaded.
    - Ensure that the O-ring is not pinched.
    - Do not over tighten the plug.

14. Use the 8-mm Allen wrench to refit the oil filler plug.
15. Start the detector. See "Starting the detector" on page 2-2.
16. Gas-ballast the roughing pump. See "Gas ballasting the roughing pump" on page 5-20.

    Tips: After you add oil to the pump, the following situations can occur:

    - The oil level drops slightly during the first month of operation.
    - The oil changes color (darkens) over time.

- After running the pump for 12 to 48 hours, it is common to see a few drops of oil near the filler plug. Excess oil around the lip of the filler plug will run down and drip off the pump once the pump reaches operating temperature.
- When the pump begins to run at normal operating temperature, spilled oil smells slightly.

Replacing the roughing pump's oil demister element

Replace the roughing pump's oil demister element annually.

Note: This procedure is not required for an Alcatel oil-free roughing pump.

Required materials:

- Chemical-resistant, powder-free gloves
- 6-mm Allen wrench
- 10-mm wrench

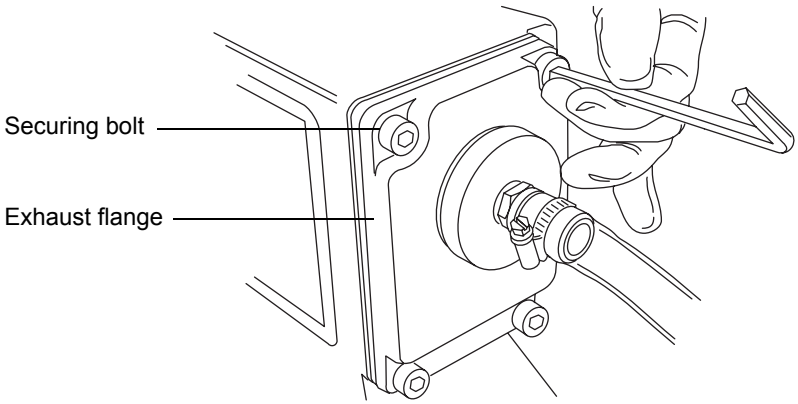
To remove the roughing pump oil demister element

1. Vent and shut-down the detector. See "Shutting down the detector" on page 2-12.
2. Allow the roughing pump to cool.

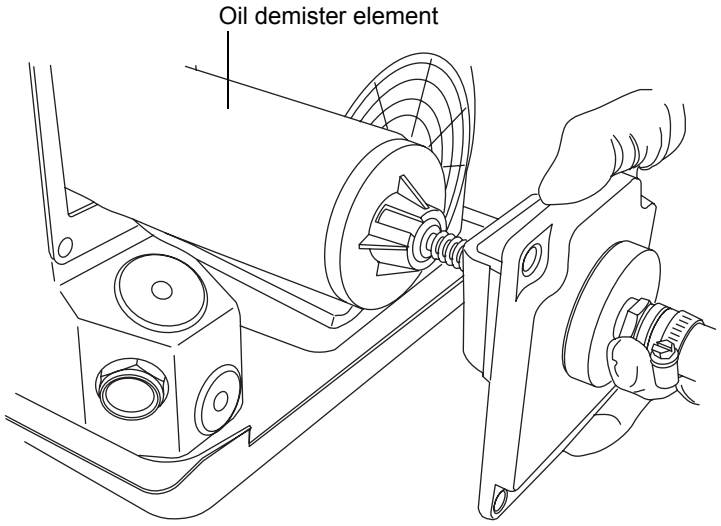
Warning: The pump oil can be contaminated with analyte accumulated during normal operation. Always wear chemical-resistant, powder-free gloves when replacing the oil demister element.

Warning: To avoid burn injuries, take great care while working with the roughing pump: it can be hot.

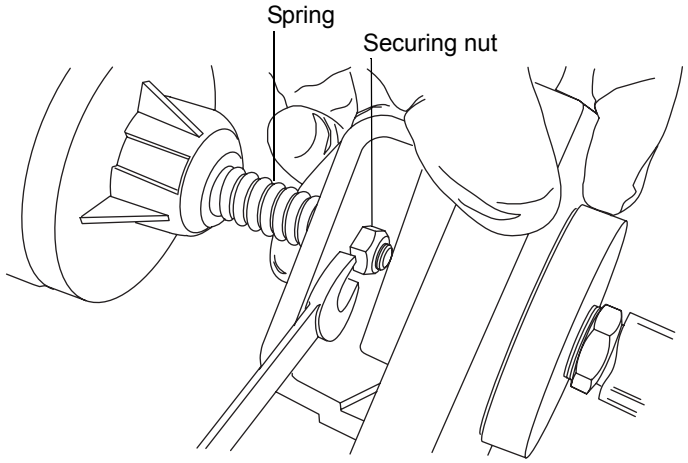
3. Use the 6-mm Allen wrench to remove the 4 bolts securing the exhaust flange to the roughing pump.



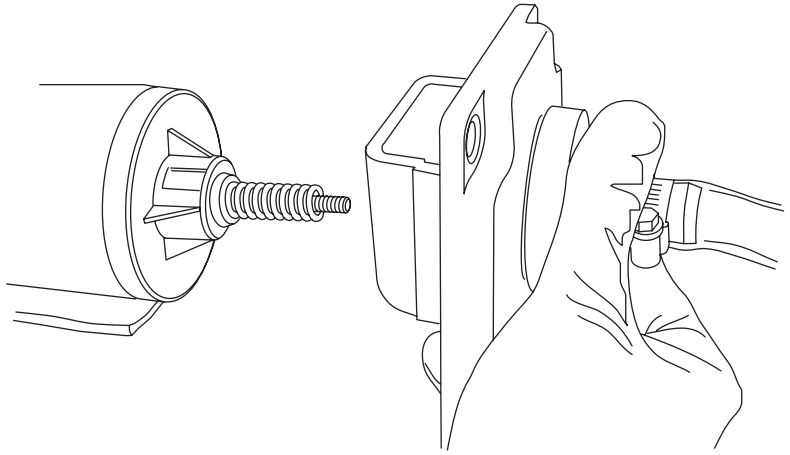
4. Using both hands, carefully remove the exhaust flange and oil demister element from the roughing pump.



5. Use the 10-mm wrench to remove the nut that secures the oil demister element to the exhaust flange.



6. Holding the oil demister element slightly elevated to prevent the loss of the spring, remove the exhaust flange from the oil demister element.



7. Remove the spring from the oil demister element.

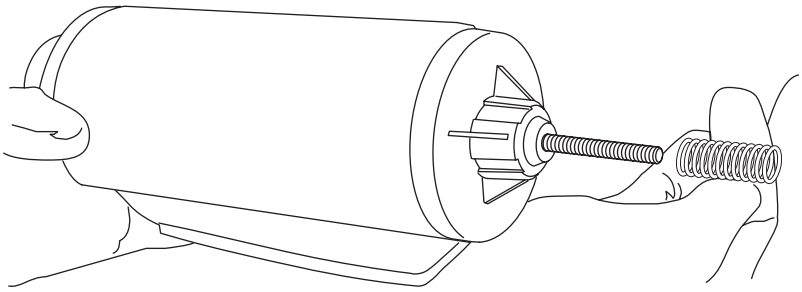
Warning: The oil demister element can be contaminated with biohazardous and/or toxic materials. Ensure that it is correctly disposed of according to local environmental regulations.

8. Dispose of the oil demister element in accordance with local environmental regulations.

To fit the new oil demister element

Warning: The pump oil can be contaminated with analyte accumulated during normal operation. Always wear chemical-resistant, powder-free gloves when replacing the oil demister element.

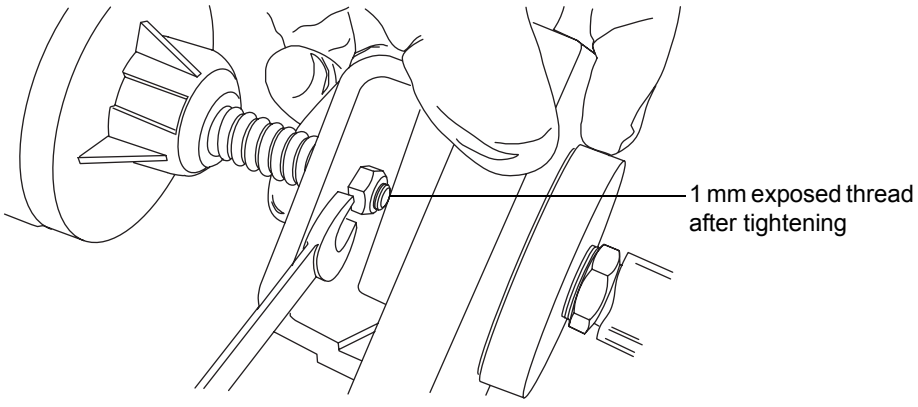
1. Fit the spring to the new oil demister element.



2. Holding the oil demister element slightly elevated to prevent the loss of the spring, fit the exhaust flange to the oil demister element.

Caution: The nut that secures the oil demister element to the exhaust flange must not be overtightened; ensure that only approximately 1 mm of thread is exposed beyond the nut when it is tightened.

3. Use the 10-mm wrench to fit and tighten the nut that secures the oil demister element to the exhaust flange.



4. Ensure that the inscription “TOP” is at the top of the oil demister element, and, using both hands, carefully fit the oil demister element and exhaust flange to the roughing pump.

   Caution: The bolts securing the source exhaust flange to the roughing pump must each be sequentially and incrementally tightened until they are all fully tight.

5. Use the 6-mm Allen wrench to fit the 4 bolts securing the exhaust flange to the roughing pump.
6. Start the detector. See “Starting the detector” on page 2-2.

6 Optional APCI Mode of Operation

This chapter describes the optional atmospheric pressure chemical ionization (APCI) mode of operation, which uses the IonSABRE APCI source.

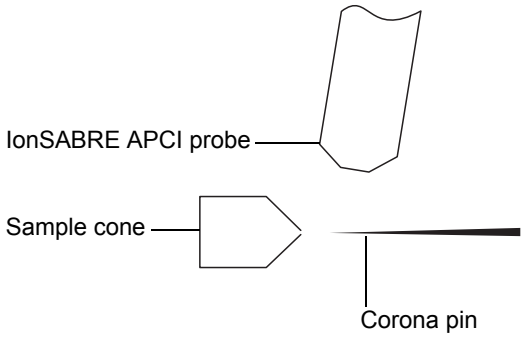
Contents

Atmospheric pressure chemical ionization

APCI, an option for the detector, produces singly charged protonated or deprotonated molecules for a broad range of nonvolatile analytes.

The APCI interface consists of the standard source fitted with a corona pin and a heated IonSABRE APCI probe. Mobile phase from the LC column enters the probe, where it is pneumatically converted to an aerosol, rapidly heated, and vaporized or gasified at the probe tip.

APCI mode



Hot gas from the IonSABRE APCI probe passes between the sample cone and the corona pin, which is typically operated with a discharge current of 5 µA. Mobile phase molecules rapidly react with ions generated by the corona discharge to produce stable reagent ions. Analyte molecules introduced into the mobile phase react with the reagent ions at atmospheric pressure and typically become protonated (in the positive ion mode) or deprotonated (in the negative ion mode). The sample and reagent ions then pass through the sample cone and into the mass spectrometer.

IonSABRE APCI probe

In the IonSABRE APCI probe, the nebulized gas plume expands in a directly heated region with a larger internal diameter. The increased aerosol expansion gives more efficient droplet evaporation than the standard ESI probe. The nebulizer support gas controls the droplet residence times and positively sweeps the sample from the probe, giving optimized probe performance. The gas flow must be maintained at all times.

Installing the IonSABRE APCI probe

Required material: Chemical-resistant, powder-free gloves

To install the IonSABRE APCI probe

Warning: The LC system connections, IonSABRE APCI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

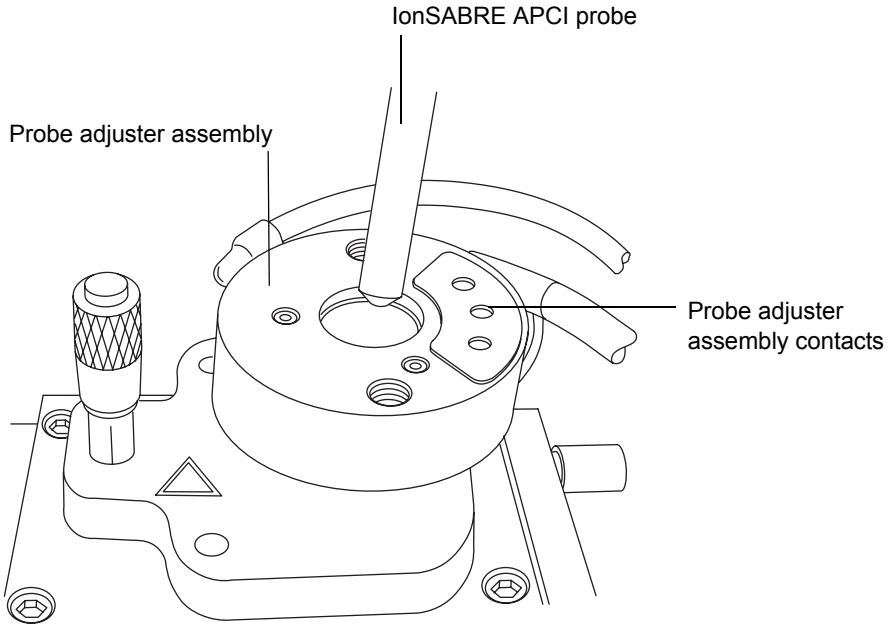
1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

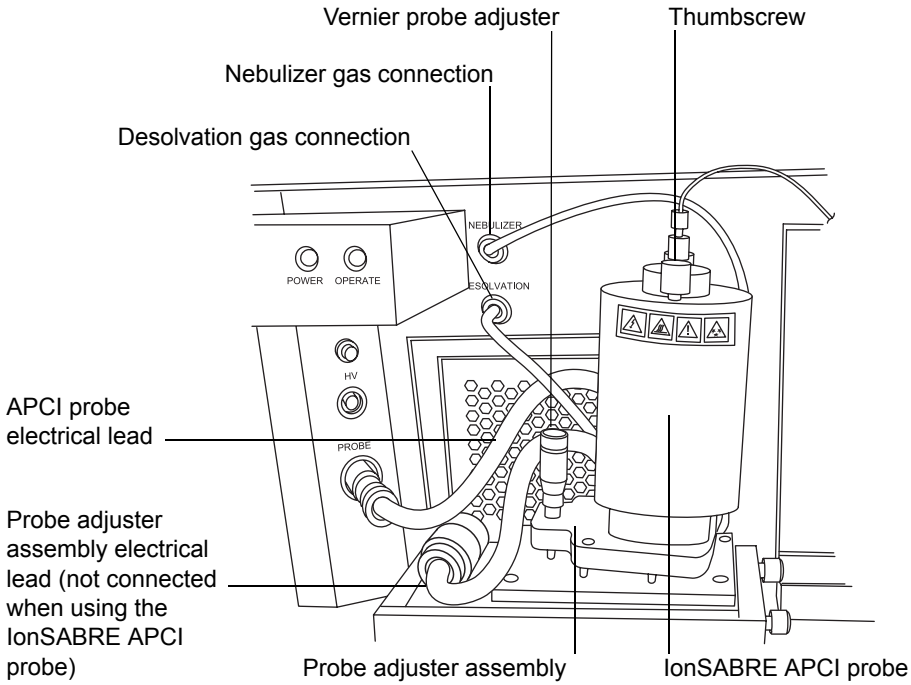
2. Open the instrument's access door.

3. Ensure that the contacts on the IonSABRE APCI probe align with the probe adjuster assembly contacts, and carefully slide the IonSABRE APCI probe into the hole in the probe adjuster assembly.



4. Secure the IonSABRE APCI probe by tightening the 2 thumbscrews shown in the following figure.

IonSABRE APCI probe mounted on the source enclosure, showing the connections to the front panel



5. Connect the IonSABRE APCI probe's PTFE tube to the nebulizer gas connection.
6. At the instrument's front panel, disconnect the probe adjuster assembly's electrical lead from the probe connection.
7. Connect the IonSABRE APCI probe's electrical lead to the instrument's probe connection.

Warning: To avoid electric shock, do not use stainless steel tubing to connect the diverter valve to the IonSABRE APCI probe; use the PEEK™ tubing supplied with the instrument.

8. Using tubing of the appropriate internal diameter (ID), connect the fluidics system's diverter valve to the IonSABRE APCI probe. Two tubes of differing ID are supplied with the instrument.

   Requirement: If you are replacing the tubing supplied with the instrument, minimize the length of the tube connecting the diverter valve to the IonSABRE APCI probe. Doing so minimizes delays and dispersion.

9. Close the instrument's access door.

Installing the corona pin

To install the corona pin

Refer to "Installing the corona pin" on page 3-5.

Removing the corona pin

To remove the corona pin

Refer to "Removing the corona pin" on page 3-9.

Removing the IonSABRE APCI probe

Required material: Chemical-resistant, powder-free gloves

To remove the IonSABRE APCI probe

Warning: The LC system connections, IonSABRE APCI probe, and source can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

Warning: To avoid electric shock, ensure that the instrument is suitably prepared before commencing this procedure.

1. Prepare the instrument for working on the source. See "Preparing the instrument for working on the source" on page 5-6.

   Warning: The source can be hot. To avoid burn injuries, take great care while working with the instrument's access door open.

2. Open the instrument's access door.
3. Disconnect the diverter valve tubing from the IonSABRE APCI probe.
4. Disconnect the IonSABRE APCI probe's electrical lead from the instrument's probe connection.
5. Disconnect the IonSABRE APCI probe's PTFE tube from the nebulizer gas connection.
6. Undo the 2 thumbscrews securing the probe to the probe adjuster assembly.
7. Carefully remove the probe from the probe adjuster assembly.
8. Close the instrument's access door.

A Safety Advisories

Waters instruments display hazard symbols designed to alert you to the hidden dangers of operating and maintaining the instruments. Their corresponding user guides also include the hazard symbols, with accompanying text statements describing the hazards and telling you how to avoid them. This appendix presents all the safety symbols and statements that apply to the entire line of Waters products.

Contents

Warning symbols

Warning symbols alert you to the risk of death, injury, or seriously adverse physiological reactions associated with an instrument's use or misuse. Heed all warnings when you install, repair, and operate Waters instruments. Waters assumes no liability for the failure of those who install, repair, or operate its instruments to comply with any safety precaution.

Task-specific hazard warnings

The following warning symbols alert you to risks that can arise when you operate or maintain an instrument or instrument component. Such risks include burn injuries, electric shocks, ultraviolet radiation exposures, and others.

When the following symbols appear in a manual's narratives or procedures, their accompanying text identifies the specific risk and explains how to avoid it.

Warning: (General risk of danger. When this symbol appears on an instrument, consult the instrument's user documentation for important safety-related information before you use the instrument.)

Warning: (Risk of burn injury from contacting hot surfaces.)

Warning: (Risk of electric shock.)

Warning: (Risk of fire)

Warning: (Risk of needle puncture.)

Warning: (Risk of injury caused by moving machinery.)

Warning: (Risk of exposure to ultraviolet radiation.)

Warning: (Risk of contacting corrosive substances.)

Warning: (Risk of exposure to a toxic substance.)

Warning: (Risk of personal exposure to laser radiation.)

Warning: (Risk of exposure to biological agents that can pose a serious health threat.)

Warnings that apply to particular instruments, instrument components, and sample types

The following warnings can appear in the user manuals of particular instruments and on labels affixed to them or their component parts.

Burst warning

This warning applies to Waters instruments fitted with nonmetallic tubing.

Warning: Pressurized nonmetallic, or polymer, tubing can burst. Observe these precautions when working around such tubing:

- Wear eye protection.
- Extinguish all nearby flames.
- Do not use tubing that is, or has been, stressed or kinked.
- Do not expose nonmetallic tubing to incompatible compounds like tetrahydrofuran (THF) and nitric or sulfuric acids.
- Be aware that some compounds, like methylene chloride and dimethyl sulfoxide, can cause nonmetallic tubing to swell, which significantly reduces the pressure at which the tubing can rupture.

Mass spectrometer flammable solvents warning

This warning applies to instruments operated with flammable solvents.

Warning: Where significant quantities of flammable solvents are involved, a continuous flow of nitrogen into the ion source is required to prevent possible ignition in that enclosed space.

Ensure that the nitrogen supply pressure never falls below 690 kPa (6.9 bar, 100 psi) during an analysis in which flammable solvents are used. Also ensure a gas-fail connection is connected to the HPLC system so that the LC solvent flow stops if the nitrogen supply fails.

Mass spectrometer shock hazard

This warning applies to all Waters mass spectrometers.

Warning: To avoid electric shock, do not remove the mass spectrometer's protective panels. The components they cover are not user-serviceable.

This warning applies to certain instruments when they are in Operate mode.

Warning: High voltages can be present at certain external surfaces of the mass spectrometer when the instrument is in Operate mode. To avoid non-lethal electric shock, make sure the instrument is in Standby mode before touching areas marked with this high voltage warning symbol.

Biohazard warning

This warning applies to Waters instruments that can be used to process material that might contain biohazards: substances that contain biological agents capable of producing harmful effects in humans.

Warning: Waters instruments and software can be used to analyze or process potentially infectious human-sourced products, inactivated microorganisms, and other biological materials. To avoid infection with these agents, assume that all biological fluids are infectious, observe good laboratory practices and, consult your organization's biohazard safety representative regarding their proper use and handling. Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Chemical hazard warning

This warning applies to Waters instruments that can process corrosive, toxic, flammable, or other types of hazardous material.

Warning: Waters instruments can be used to analyze or process potentially hazardous substances. To avoid injury with any of these materials, familiarize yourself with the materials and their hazards, observe Good Laboratory Practices (GLP), and consult your organization's safety representative regarding proper use and handling. Guidelines are provided in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals.*

Caution symbol

The caution symbol signifies that an instrument's use or misuse can damage the instrument or compromise a sample's integrity. The following symbol and its associated statement are typical of the kind that alert you to the risk of damaging the instrument or sample.

Caution: To avoid damage, do not use abrasives or solvents to clean the instrument's case.

Warnings that apply to all Waters instruments

When operating this device, follow standard quality control procedures and the equipment guidelines in this section.

Attention: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Important: Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

Achtung: Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbefugnis des Systems führen.

Avvertenza: eventuali modifiche o alterazioni apportate a questa unità e non espressamente approvate da un ente responsabile per la conformità annulleranno l'autorità dell'utente ad operare l'apparecchiatura.

Atencion: cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

注意：未經有關法規認證部門允許對本設備進行的改變或修改，可能會使使用者喪失操作該設備的權利。

注意：未经有关法规认证部门明确允许对本设备进行的改变或改装，可能会使使用者丧失操作该设备的合法性。

주의 : 기기 검교정 담당자의 승인 없이 무단으로 기기를 변경 또는 수정하는 경우에는, 그 기기 운영에 대한 허가가 취소될 수 있습니다.

注意: 規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザとしての承認が無効になる可能性があります。

Warning: Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

Attention: Manipulez les tubes en polymère sous pression avec precaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Eteignez toute flamme se trouvant à proximité de l'instrument.
- Evitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Evitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

Vorsicht: Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.

Attenzione: prestare attenzione durante l'utilizzo dei tubi di polimero pressurizzati:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Estinguere ogni fonte di ignizione circostante.
- Non utilizzare tubi soggetti che hanno subito sollecitazioni eccessive o son stati incurvati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrato.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamento nei tubi non metallici, riducendo notevolmente la resistenza alla rottura dei tubi stessi.

Advertencia: se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

警告：當在有壓力的情況下使用聚合物管線時，小心注意以下幾點：

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。

警告：当在有压力的情况下使用管线时，小心注意以下几点：

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚枫会导致非金属管线膨胀，大大降低管线的耐压能力。

경고: 폴리머재질의 튜빙을 압력하에서 사용할 때는 다음 사항에 유의하십시오.

- 압력을 받은 폴리머 튜빙 부근에서는 반드시 보호안경을 착용할 것
- 모든 화기의 접근을 금함
- 늘리거나 뒤틀린 튜빙은 사용하지 말 것
- 비금속 튜빙을 테트라히드로퓨란(THF)이나 염산 및 황산과 함께 사용하지 말 것
- 디글로로메탄(methylene chloride)와 디메틸설폭시드(dimethyl sulfoxide)는 비금속 튜빙을 팽창시켜 쉽게 파열되므로 주의할 것

警告：ポリマーチューブに圧力をかけて取り扱う場合は、次のように注意してください。

- 加圧したポリマーチューブの付近では、常に保護めがねを着用してください。
- 付近の火はすべて消してください。
- 激しい応力やねじれを受けたチューブは使用しないでください。
- テトラヒドロフラン（THF）、濃硝酸、あるいは濃硫酸には、非金属製のチューブを使用しないでください。
- ジクロロメタンやジメチルスルホキシドは非金属製のチューブを膨張させ、チューブの破断圧力を大幅に低下させますので、注意してください。

Warning: The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Attention: L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

Vorsicht: Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwenddung des Gerätes unter Umständen nicht ordnungsgemäß funktionieren.

Attenzione: l'utente deve essere al corrente del fatto che, se l'apparecchiatura viene usta in un modo specificato dal produttore, la protezione fornita dall'apparecchiatura potrà essere invalidata.

Advertencia: el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

警告：使用者必須非常清楚如果設備不是按照制造廠商指定的方式使用，那么該設備所提供的保護將被消弱。

警告: 使用者必须非常清楚如果设备不是按照制造厂商指定的方式使用, 那么该设备所提供的保护将被消弱

경고 : 제조사가 지정한 것 이외의 방법으로 기기를 사용하는 경우에는, 사용자가 위험으로부터 보호될 수 없는 경우가 발생할 수 있음에 유념하십시오.

警告: ユーザは製造業者が指定していない方法で装置を使用した場合は装置が提供する保護が損なわれることがあるということを承知しているものとします。

Warning: To protect against fire hazard, replace fuses with those of the same type and rating.

Attention: Remplacez toujours les fusibles par d'autres du même type et de la même puissance afin d'éviter tout risque d'incendie.

Vorsicht: Zum Schutz gegen Feuergefahr die Sicherungen nur mit Sicherungen des gleichen Typs und Nennwertes ersetzen.

Attenzione: per una buona protezione contro i rischi di incendio, sostituire i fusibili con altri dello stesso tipo e amperaggio.

Advertencia: sustituya los fusibles por otros del mismo tipo y características para evitar el riesgo de incendio.

警告：為了避免火災的危險，應更換同种類型及規格的保險絲。

警告: 为了避免火灾的危险, 应更换同种类型及规格的保险丝。

경고 : 화재를 방지하기 위해서는 퓨즈 교체 시 같은 종류, 같은 등급의 것을 사용하십시오.

警告: 火災の危険防止のために、ヒューズの交換は同一タイプおよび定格のもので行なってください。

Warning: To avoid possible electrical shock, disconnect the power cord before servicing the instrument.

Attention: Afin d'éviter toute possibilité de commotion électrique, débranchez le cordon d'alimentation de la prise avant d'effectuer la maintenance de l'instrument.

Vorsicht: Zur Vermeidung von Stromschlägen sollte das Gerät vor der Wartung vom Netz getrennt werden.

Attenzione: per evitare il rischio di scossa elettrica, scollegare il cavo di alimentazione prima di svolgere la manutenzione dello strumento.

Precaución: para evitar descargas eléctricas, desenchufe el cable de alimentación del instrumento antes de realizar cualquier reparación.

警告：要避免觸電，請在修理或保養器材前把電源線拔出。

警告：为避免可能引起得触电危险，在修理前请切断电源连接。

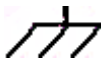
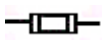
경고: 전기 충격의 가능성을 피하기 위해서는, 기기를 수리하기 이전에 전원 코드를 차단하십시오.

警告：感電の危険性を避けるために、装置の保守を行う前には装置の電源コードを引き抜いてください。

Electrical and handling symbols

Electrical symbols

These can appear in instrument user manuals and on the instrument's front or rear panels.

	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Protective conductor terminal
	Frame, or chassis, terminal
	Fuse
	Recycle symbol: Do not dispose in municipal waste.

Handling symbols

These handling symbols and their associated text can appear on labels affixed to the outer packaging of Waters instrument and component shipments.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!

B External Connections

This appendix describes the detector's external connections.

Warning: The detector is heavy. To avoid injury, Waters recommends that the detector be lifted using suitable machinery and the supplied harness.

Caution:

- Contact Waters Technical Service before moving the instrument.
- If you must transport the detector, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

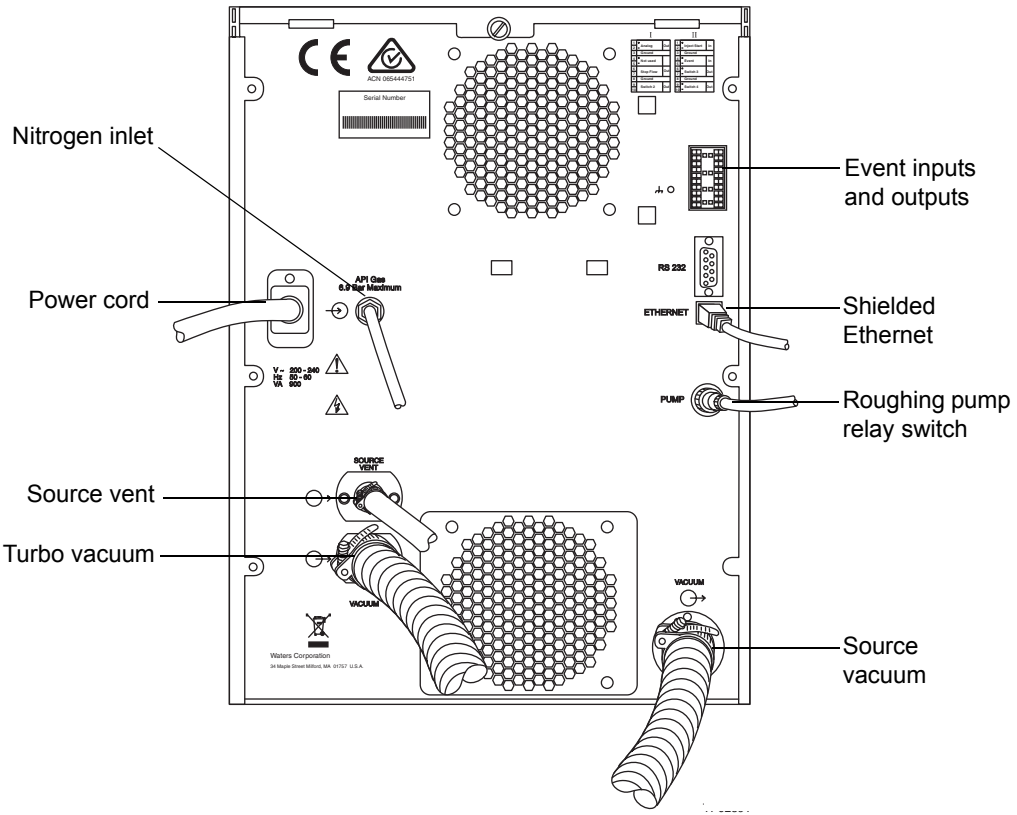
See "Safety and handling" on page 5-5.

Contents

Detector external wiring and vacuum connections

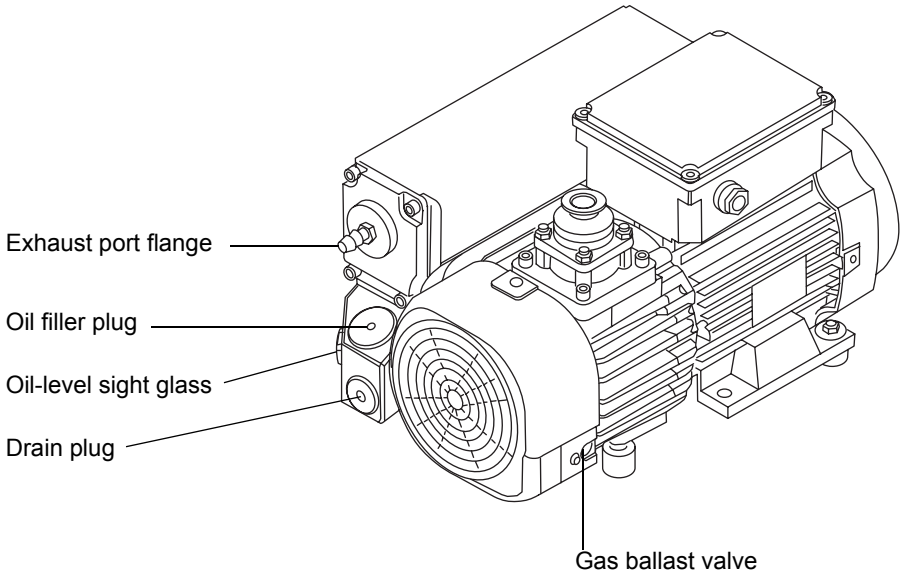
The rear panel connections for a 3100 detector system are shown below.

Detector rear panel



Connecting the oil-filled roughing pump

Note: To connect the alternative dry roughing pump, see "Connecting the oil-free roughing pump" on page B-10.



Required materials:

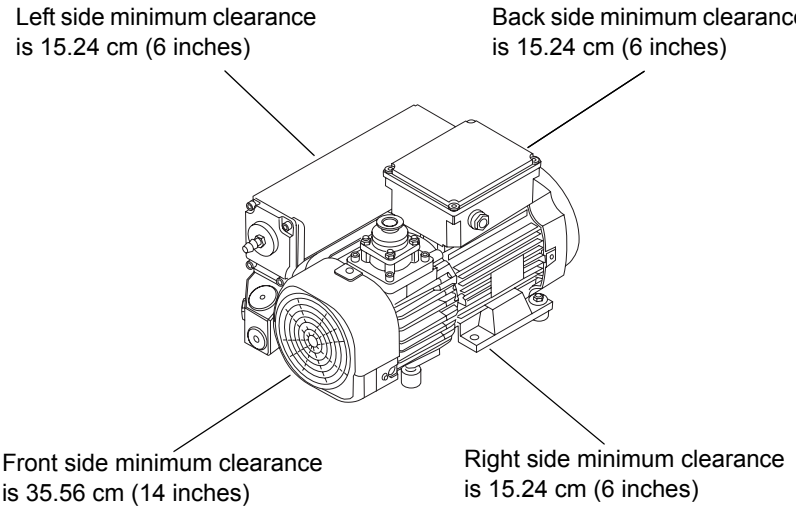
- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm Allen wrench
- Sharp knife
- 1-L exhaust trap bottle (included in the startup kit)
- Elbows (included in the Waters Rough Pump Connect Kit)
- NW25 tee (included in the startup kit)
- NW25 center rings (included in the startup kit)
- NW25 clamps (included in the startup kit)
- PVC exhaust tubing (included in the Waters Rough Pump Connect Kit)
- PVC hose clamps (included in the Waters Rough Pump Connect Kit)
- 1-inch ID vacuum hose (included in the Waters Rough Pump Connect Kit)

To connect the roughing pump

Warning: The pump and its connections can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.

Caution:

- To ensure correct operation of the roughing pump, the pump must be installed within 1 degree of horizontal.
- The area where the roughing pump is located must have an ambient temperature of 15 to 40 ºC (59 to 104 ºF).
- To ensure proper ventilation, the pump must be installed with the following minimum clearances:



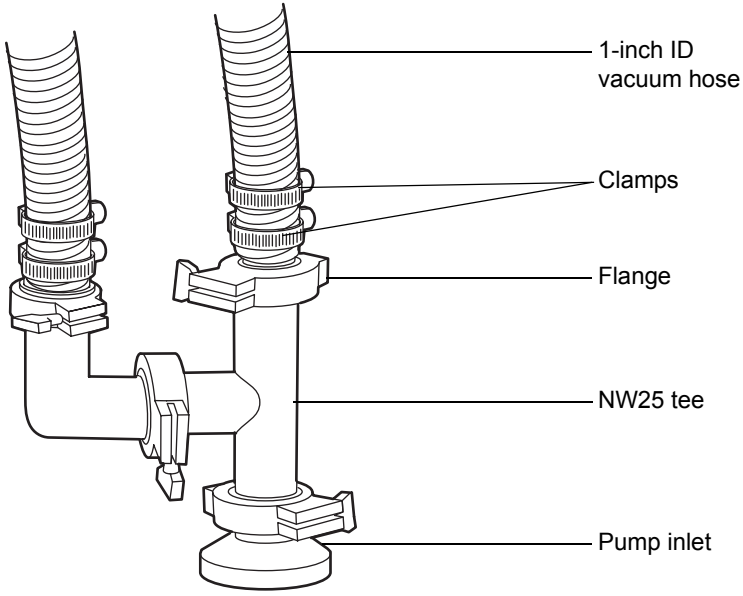
Requirement: The pump must be oriented in a way that allows easy daily access to the gas ballast valve and oil-level sight glass.

1. Place the PTFE drip tray on the floor, within 5 feet of the instrument.

   Warning: The roughing pump is heavy. To avoid injury, at least two people must lift the pump.

2. Place the pump on the PTFE drip tray.

3. Attach the NW25 tee, included in the startup kit, to the inlet of the pump using the NW25 center ring, and then secure the connection with a clamp.



4. Attach the flanged end of a length of 1-inch ID vacuum hose to each open port on the NW25 tee. Use the NW25 center rings and clamps provided in the startup kit. Use the 7-mm nut driver to install the clamps.

5. Connect the opposite ends of the two lengths of vacuum hose in step 4 to the two, 1-inch OD, straight, vacuum ports on the detector's rear panel. Secure the hose ends with clamps supplied in the startup kit; install 2 clamps on each hose end.

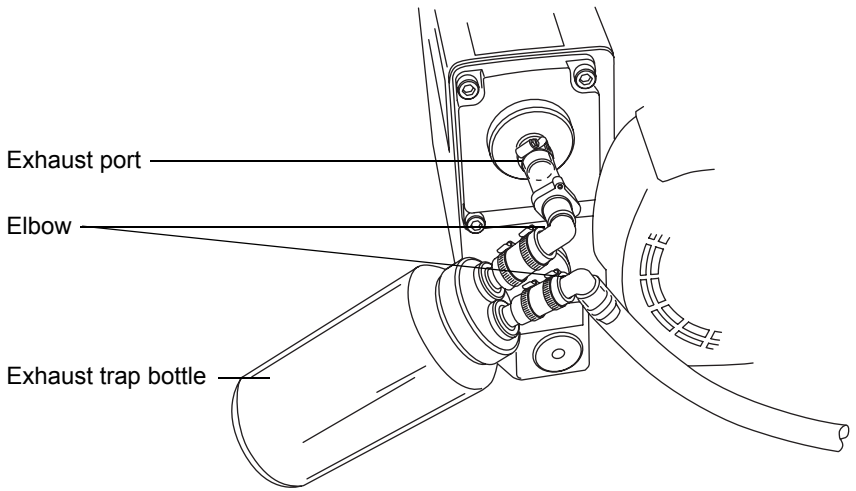
Caution:

- To prevent condensation from forming in the exhaust tubing between the roughing pump and the exhaust trap bottle, you must minimize the length of the tube.
- To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

6. Connect an approximately 36.4-cm (2.5-inch) length of 12.7-mm clear PVC exhaust tubing to the roughing pump exhaust port NW25 nozzle fitting. Secure the tubing with a hose clamp.

   Caution: To prevent condensation from draining backward and damaging the pump, the exhaust tubing must be installed with an exhaust trap bottle; the bottle must be positioned at or below the roughing pump exhaust port.

7. Connect an elbow to the other end of the PVC exhaust tubing, and connect the elbow to one of the fittings on the exhaust trap bottle (included in the startup kit).



Caution: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

8. Connect a length of 12.7-mm clear PVC exhaust tubing to an elbow and connect the elbow to the other fitting on the exhaust trap bottle. The exit line of the exhaust trap bottle can be at any elevation.
9. Secure the exhaust trap bottle in a conspicuous location.

Caution: The instrument requires two separate exhaust systems: one for nitrogen, the other for the roughing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

10. Route the open end of the exhaust tubing to a suitable exhaust vent.
11. Check the oil level in the pump.

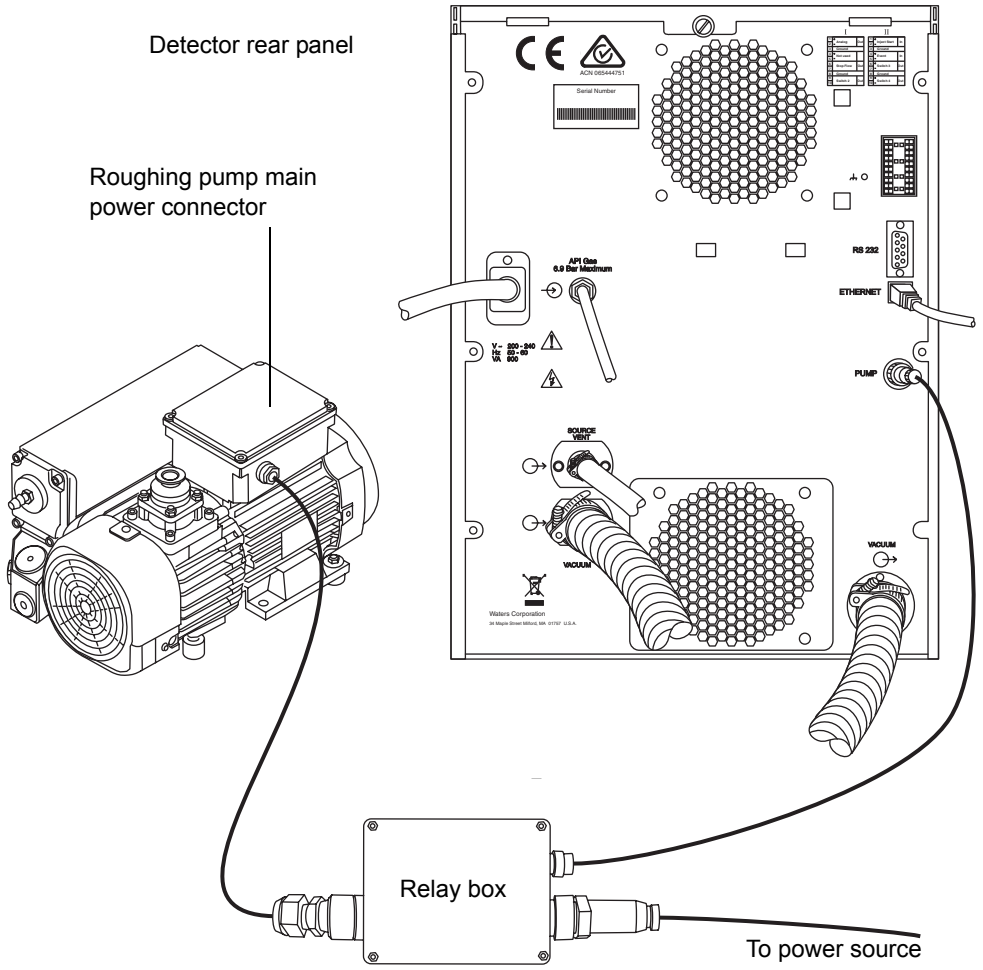
Caution: To ensure correct operation of the roughing pump, do not operate the pump with the oil level at less than 30% of the MAX level.

See "Checking the roughing pump oil level" on page 5-23, and, if needed, "Adding oil to the roughing pump" on page 5-23.

12. Make the electrical connections to the roughing pump.
    - If your roughing pump has an external relay box, see "Making the electrical connections for a roughing pump with an external relay box" on page B-8.
    - If your roughing pump does not have an external relay box, see "Making the electrical connections for a roughing pump without an external relay box" on page B-9.

Making the electrical connections for a roughing pump with an external relay box

Roughing pump connections with an external relay box



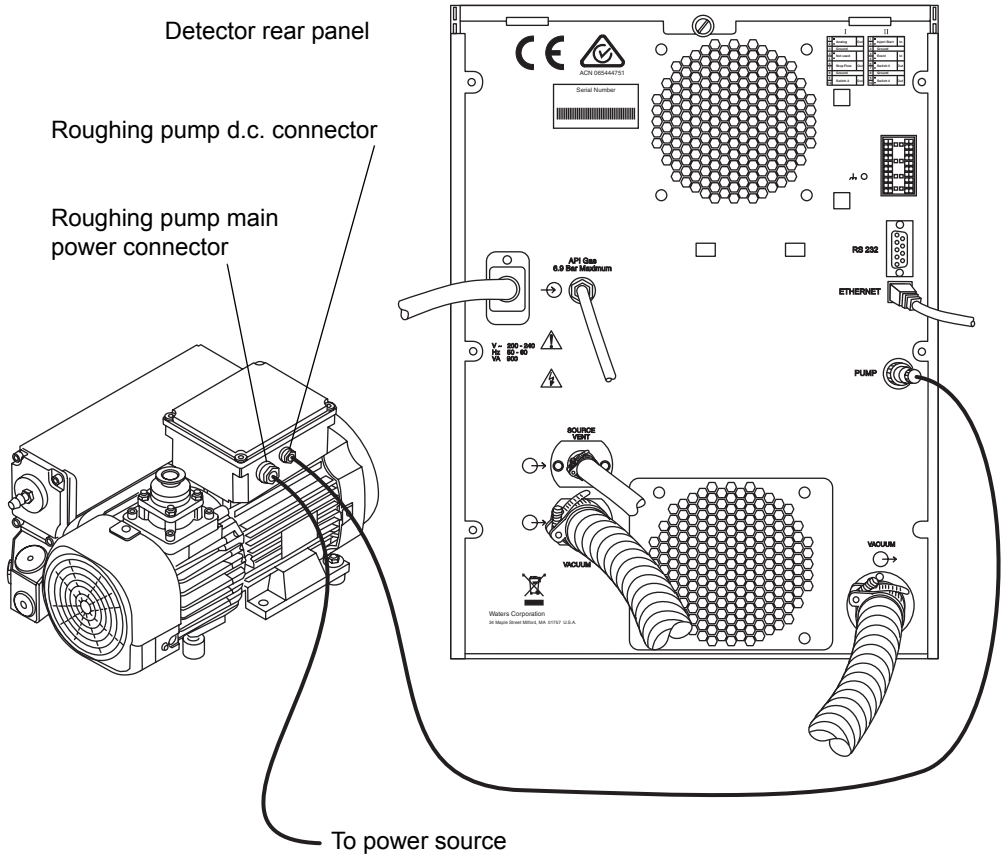
To make the electrical connections for a roughing pump with an external relay box

1. Connect the power cable from the roughing pump relay box connector to the relay box.

2. Connect the relay cable from the relay box to the pump connector on the detector's rear panel.
3. Connect the relay box power connector to the main power source.

Making the electrical connections for a roughing pump without an external relay box

Roughing pump connections without an external relay box



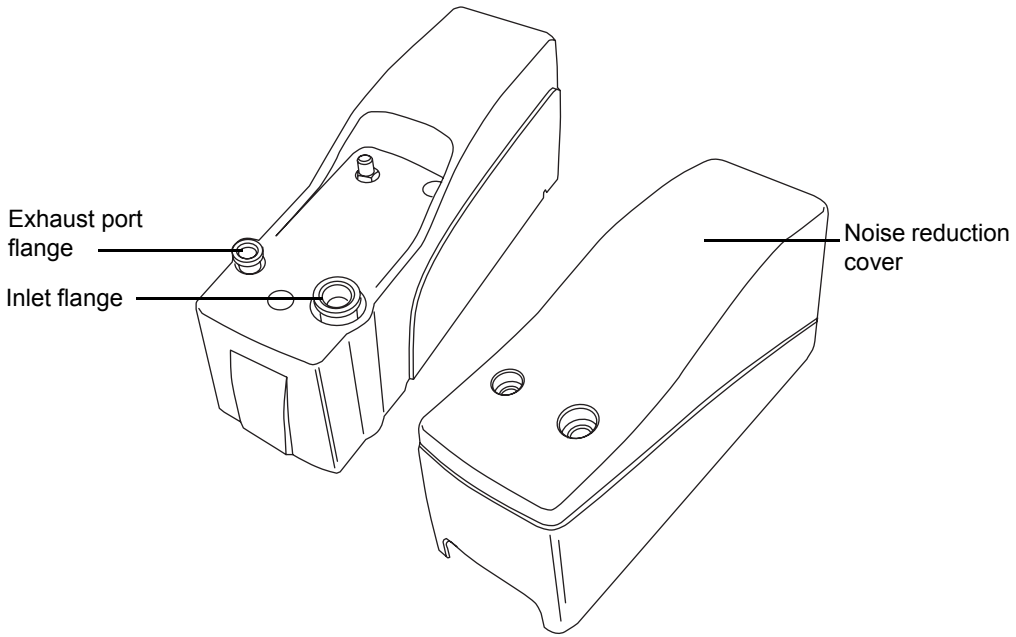
To make the electrical connections for a roughing pump without an external relay box

1. Connect the roughing pump power cord to the main power source.
2. Connect the relay cable from the roughing pump d.c. connector to the pump connector on the detector's rear panel.

Connecting the oil-free roughing pump

The oil-free roughing pump is an optional alternative to the standard oil-filled roughing pump. To connect the oil-filled roughing pump, see "Connecting the oil-filled roughing pump" on page B-3.

The noise reduction cover must be installed over the pump to minimize operating noise, unless the pump is installed in a cabinet that includes sound dampening and ventilation.



Required materials:

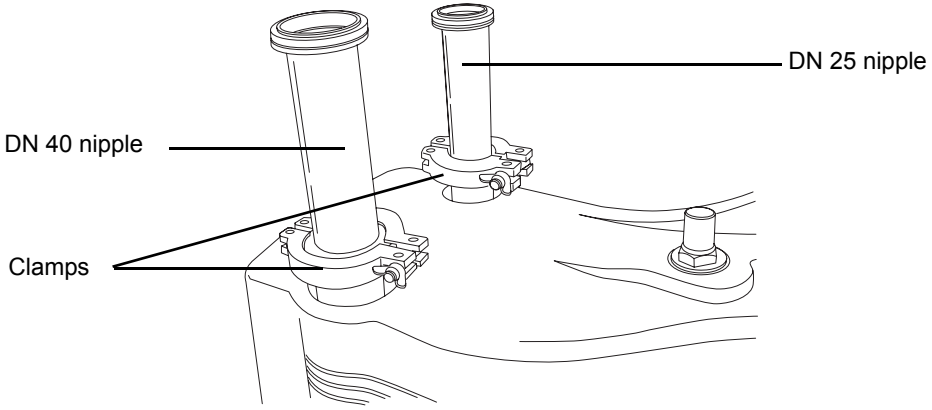
- Chemical-resistant, powder-free gloves
- 7-mm nut driver
- 8-mm Allen wrench

- Sharp knife
- 1-L exhaust trap bottle (included in the startup kit)
- Elbows (included in the Waters Rough Pump Connect Kit)
- NW25 tee (included in the startup kit)
- NW25 center rings (included in the startup kit)
- NW25 clamps (included in the startup kit)
- NW25 full nipple (included in the Alcatel pump kit)
- DN25 reducing nipple (included in the Alcatel pump kit)
- NW40 center rings (included in the Alcatel pump kit)
- NW40 clamps (included in the Alcatel pump kit)
- DN40 full nipple flange (included in the Alcatel pump kit)
- PVC exhaust tubing (included in the Waters Rough Pump Connect Kit)
- PVC hose clamps (included in the Waters Rough Pump Connect Kit)
- 1-inch ID vacuum hose (included in the Waters Rough Pump Connect Kit)
- Isolation valve (included in the Alcatel pump kit)
- External silencer (included in the Alcatel pump kit)
- Noise reduction cover (included in the Alcatel pump kit)

To install the noise reduction cover

1. Remove the clamp and blank flange from the pump inlet.
2. Attach the DN40 nipple to the top of the inlet filter and o-ring assembly and then secure the connection with a clamp.
3. Attach the DN25 nipple to the outlet fitting and secure the connection with a clamp.
4. Connect the gray pump control cable to the rear of the pump.

5. Connect the power cord to the rear of the pump.
6. Install the noise reduction cover.

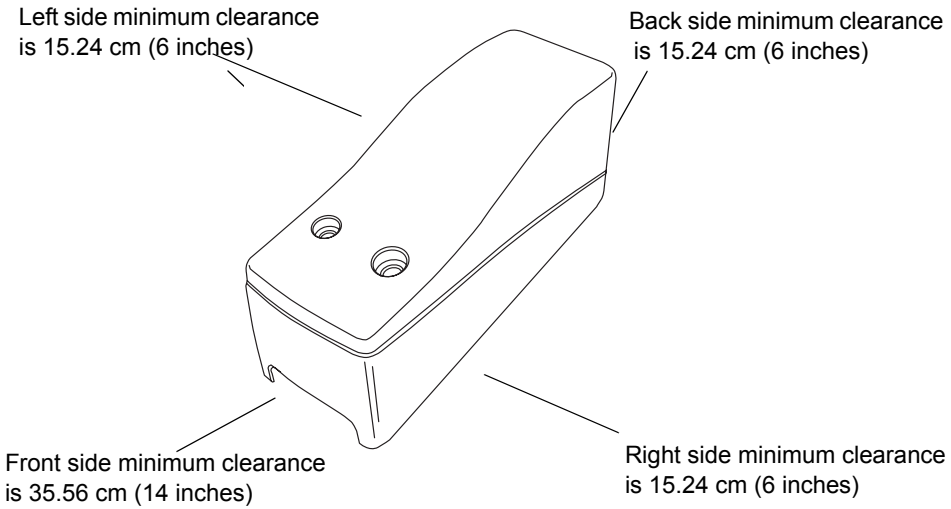


To connect the oil-free roughing pump

Warning: The pump and its connections can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.

Caution:

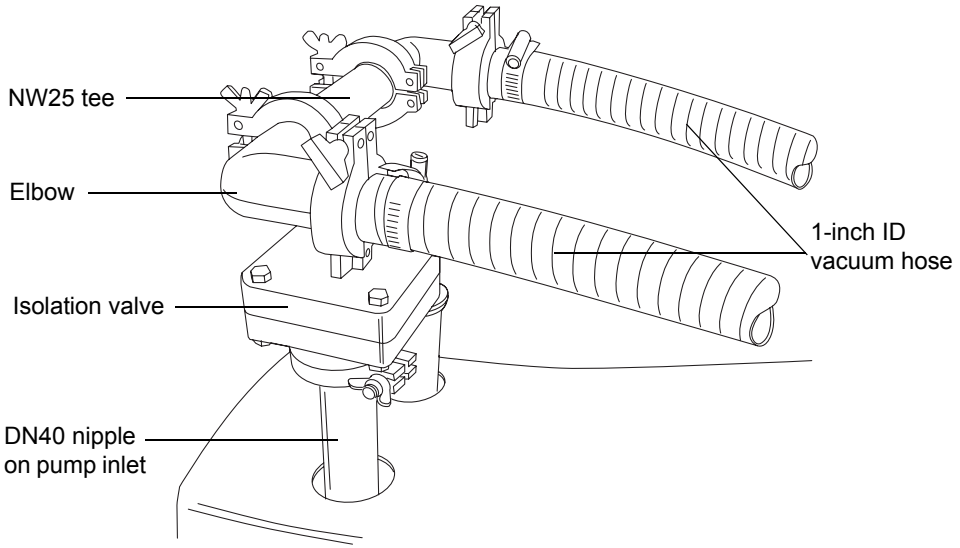
- To ensure correct operation of the roughing pump, the pump must be installed within 1 degree of horizontal.
- The area where the roughing pump is located must have an ambient temperature of 15 to 40 °C (59 to 104 °F).
- To ensure proper ventilation, the pump must be installed with the following minimum clearances:



Warning: The roughing pump is heavy. To avoid injury, at least two people must lift the pump.

1. Place the pump on the floor, within 1.5 m (5 feet) of the instrument.

2. Attach the isolation valve, NW25 tee, and elbows to the DN40 nipple on the pump inlet, and then secure these connections with clamps, as shown in the figure below.



3. Attach the flanged end of a length of 1-inch ID vacuum hose to each open port on the NW25 tee. Use the NW25 center rings and clamps provided in the startup kit. Use the 7-mm nut driver to install the clamps.

4. Connect the opposite ends of the two lengths of vacuum hose in step 3 to the two, 1-inch OD, straight, vacuum ports on the detector's rear panel. Secure the hose ends by installing 2 clamps supplied in the startup kit on each hose end.

Caution:

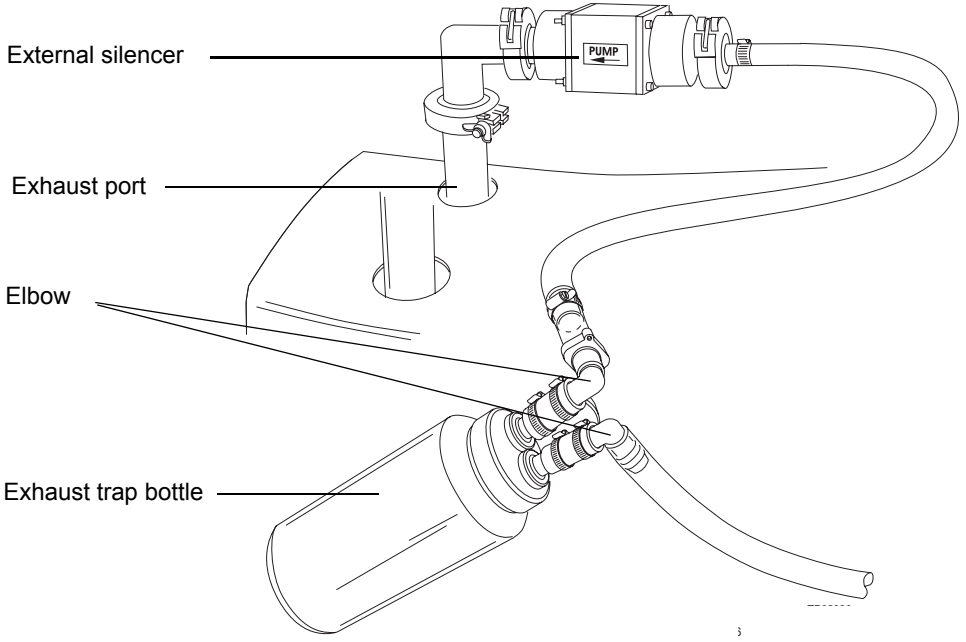
- To prevent condensation from forming in the exhaust tubing between the roughing pump and the exhaust trap bottle, you must minimize the length of the tube.
- To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

5. Attach the DN25 elbow to the DN25 nipple on the pump exhaust outlet and secure the connection with a clamp.

6. Install the external silencer, with the arrow pointing toward the pump, to the open port of the DN25 elbow, and then secure the connection with a clamp.
7. Attach the DN25 reducing nipple to the outlet of the external silencer and secure the connection with a clamp.
8. Connect an approximately 300 mm (12 inch) length of 12.7-mm clear PVC exhaust tubing to the DN25 reducing nipple. Secure the tubing with a hose clamp.

   Caution: To prevent condensation from draining backward and damaging the pump, the exhaust tubing must be installed with an exhaust trap bottle; the bottle must be positioned at or below the roughing pump exhaust port.

9. Connect an elbow to the other end of the PVC exhaust tubing, and connect the elbow to one of the fittings on the exhaust trap bottle (included in the startup kit).

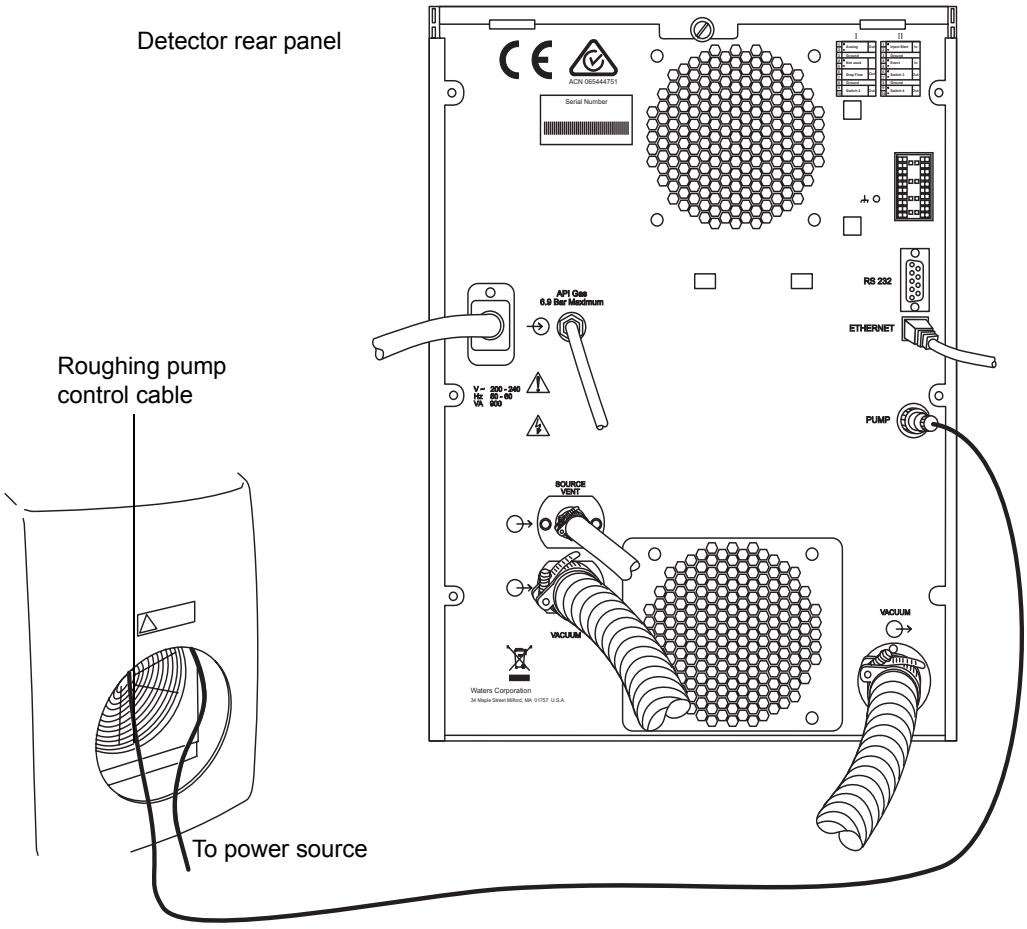


Caution: To avoid gas leaks, use the sharp knife to cut the PVC exhaust tubing squarely (that is, perpendicular to its horizontal axis).

10. Connect a length of 12.7-mm clear PVC exhaust tubing to an elbow and connect the elbow to the other fitting on the exhaust trap bottle. The exit line of the exhaust trap bottle can be at any elevation.
11. Secure the exhaust trap bottle in a conspicuous location.
12. Route the open end of the exhaust tubing to a suitable exhaust vent.
13. Make the electrical connections to the roughing pump.

Making the electrical connections for an oil-free roughing pump

Roughing pump connections



To make the electrical connections for a oil-free roughing pump

1. Route the cables through the opening in the rear of the noise reduction cover.
2. Connect the gray pump control cable to the pump connector on the detector's rear panel.
3. Connect the power cable and power-on the instrument.

Connecting to the nitrogen gas supply

Required materials:

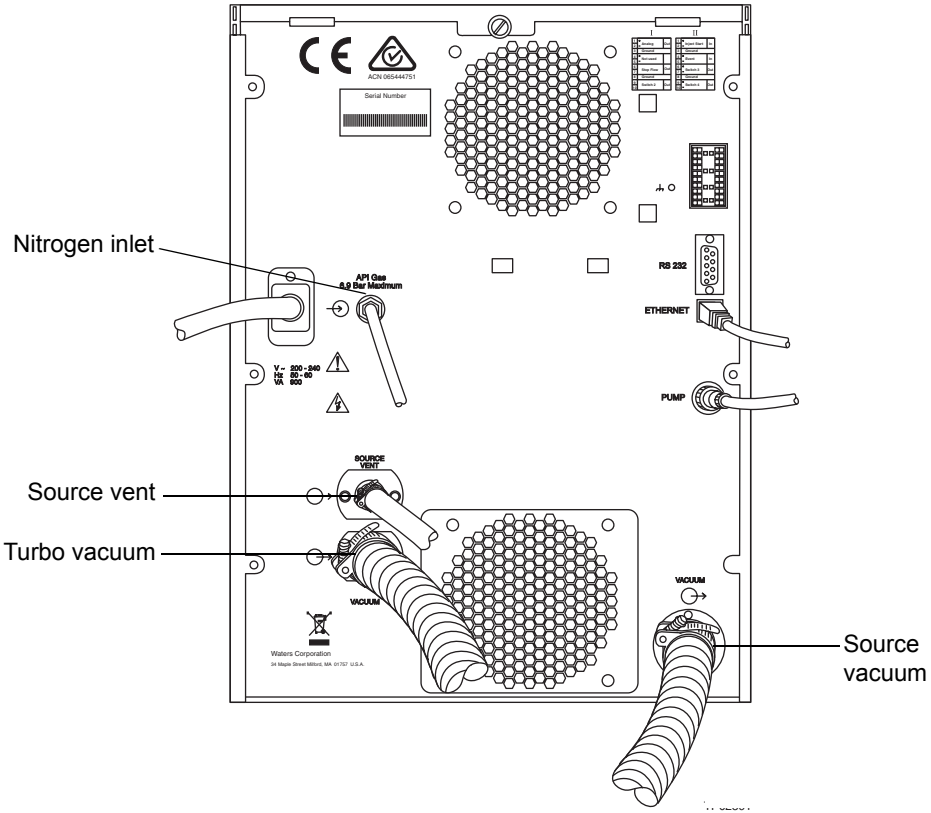
- Chemical-resistant, powder-free gloves
- Sharp knife
- Wrench
- 6-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)

To connect the nitrogen gas supply

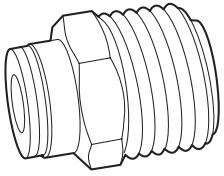
Caution: To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

1. Use the sharp knife to cut a 3.8 to 5.0-cm (1.5 to 2-inch) length of 6-mm PTFE tubing.
2. Connect this piece of tubing to one end of the nitrogen supply in-line filter.
3. Connect the remaining length of the 6-mm PTFE tubing to the other end of the filter.
4. Connect the free end of the short piece of 6-mm PTFE tubing to the nitrogen inlet port on the rear of the instrument.

Nitrogen gas supply, and exhaust connections



5. Attach a nitrogen regulator (not provided) to the nitrogen supply.
6. Install the 6-mm stud into the regulator outlet.



7. Connect the free end of the long piece of 6-mm PTFE tubing to the 6-mm stud.

Connecting the nitrogen exhaust line

Required materials:

- Chemical-resistant, powder-free gloves
- Sharp knife
- 10-mm and 12-mm PTFE tubing (included in the Waters Rough Pump Connect Kit)
- snoop® (or equivalent) leak detector liquid

To connect the nitrogen exhaust line

Warning:

- LC solvents and analytes can be carried in the nitrogen exhaust, which must be vented via the nitrogen exhaust trap bottle and laboratory exhaust system. The laboratory exhaust system must provide a minimum vacuum of 0.20 kPa (2 mbar, 0.03 psi) below atmospheric pressure (negative pressure).
- The exhaust connections can be contaminated with biohazardous and/or toxic materials. Always wear chemical-resistant, powder-free gloves when performing this procedure.
- To avoid the buildup of hazardous gases, do not place the nitrogen exhaust trap bottle in an enclosed cabinet.

Caution: The instrument requires two separate exhaust systems: one for nitrogen, the other for the roughing pump. Vent them to atmosphere through separate exhaust lines. Oil mist can seriously damage the instrument if the nitrogen exhaust line connects with the roughing pump exhaust line. Your warranty does not cover damage caused by routing exhaust lines incorrectly.

1. Locate the exhaust trap bottle in an accessible area below the instrument. See the figure “Exhaust trap bottle” on page B-22.

Caution: To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

2. Cut a length of 12-mm tubing long enough to connect the instrument to the exhaust trap bottle.
3. Connect one end of the tubing to the exhaust port on the rear panel. Connect the other end to one of two ports on the exhaust trap bottle.

Caution: To avoid gas leaks, use the sharp knife to cut the PTFE tubing squarely (that is, perpendicular to its horizontal axis).

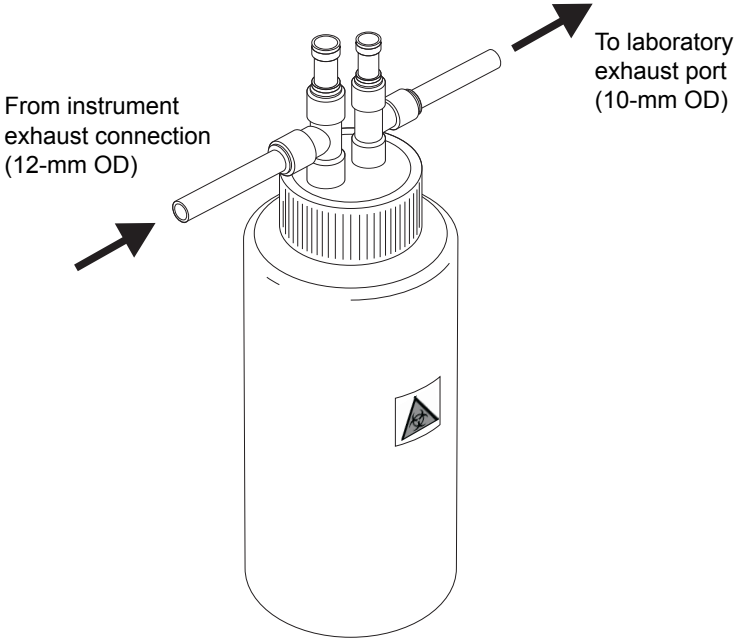
4. Cut a second length of 10-mm tubing long enough to connect the exhaust trap bottle to the exhaust vent.
5. Insert one end of the tubing into the remaining port on the exhaust trap bottle. Route the other end to the exhaust vent.

Warning: To confirm the integrity of the source exhaust system, the following leak test must be performed.

Caution: To avoid damage to the instrument, snoop (or its equivalent) leak detector liquid must be used only for the purpose described in the following step. It must not be used on any other part of the instrument.

6. Use snoop (or equivalent) leak detector liquid to ensure that there are no leaks at the instrument exhaust and laboratory exhaust system line connections.

Exhaust trap bottle



Connecting the liquid waste line

Required material: Chemical-resistant, powder-free gloves

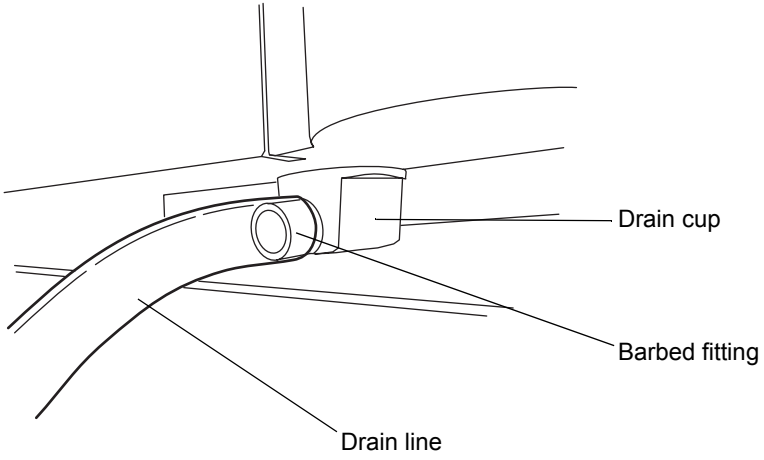
To connect the liquid waste line

Warning: The waste line and connection can be contaminated with biologically hazardous materials. Always wear chemical-resistant, powder-free gloves while performing this procedure.

1. Place a suitable waste container below the detector.

   Caution: To avoid distorting the drip tray or causing the drain cup to leak, restrain the drain cup when attaching or removing the waste line.

2. Slide a drain line over the barbed fitting of the drain (located at the bottom of the detector).

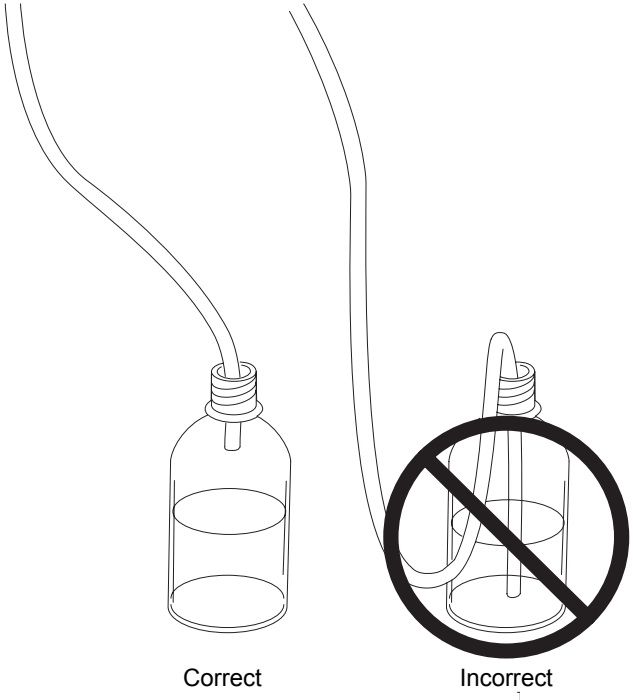


Warning: To prevent leakage of biologically hazardous materials, ensure that the

- drain line does not crimp or bend. A crimp or bend can impede flow to the waste container.
- waste container is emptied before the lower end of the drain tube is covered by waste solvent.

3. Route the waste line to the waste container. If necessary, shorten the waste tube so that its end is above the surface of the waste solvent.

Positioning of drain tube



Connecting the workstation

Before connecting the workstation to the instrument, set up the workstation according to its accompanying instructions. Locate the workstation within 5 meters (16 feet) of the instrument.

Requirement: Shielded network cables must be used with the detector to ensure compliance with FCC limits.

To connect the workstation

1. Connect the monitor to the PC.
2. Connect one end of the shielded network cable to the appropriate port on the rear panel of the detector.
3. Connect the other end of the shielded network cable to the port labeled instrument LAN on the workstation rear panel.

To connect the instrument to the power source

Caution: Do not connect the instrument's power supply cord until you complete the installation procedures in the previous sections.

1. Select the correct power cord for your location.
2. Connect the female end of the power cord to the power port on the rear panel of the instrument.

Connecting Ethernet cables

Requirement: Shielded Ethernet cables must be used with the detector to ensure compliance with FCC limits.

To make Ethernet connections

1. Connect one end of one shielded Ethernet cable to the network switch, and then connect the other end to the Ethernet card on the preconfigured workstation.

   Tip: On preconfigured systems, the Ethernet card is identified as the Instrument LAN card.

2. Connect one end of the other shielded Ethernet cable to the back of the detector, and then connect the other end to the network switch.

I/O signal connectors

Warning: To avoid electric shock, all electrical connections to the rear panel must be separated from hazardous voltages by double or reinforced insulation. Circuits of this type are classified as safety extra low voltage (SELV). Examples of circuits that are typically SELV include contact closure inputs and outputs for auto-samplers, and UV, RI, and fluorescence detector signal outputs for LC/MS systems. The electrical connections on the rear panel of this mass spectrometer are all SELV.

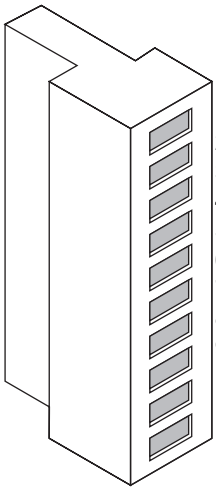
To avoid electric shock and damage to the instrument, do not apply more than

- ±30 V d.c. to the Analog (Out) connection.
- 30 V d.c. to the Stop Flow (Out), Inject Start (In), Switch 2 (Out), Switch 3 (Out), and Switch 4 (Out) connections.

The detector's rear panel includes two removable connectors that hold the screw terminals for I/O signals. These connectors are keyed so that they can receive a signal cable inserted only one way.

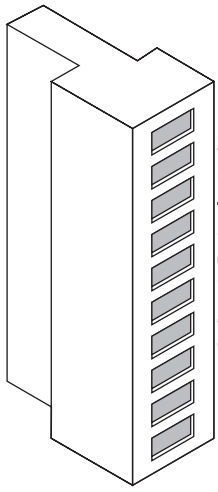
I/O signal connectors

Connector I



1	+	Analog (Out)
2	–	Analog (Out)
3		Ground
4		Not Used
5		Not Used
6		Stop Flow (Out)
7		Stop Flow (Out)
8		Ground
9		Switch 2 (Out)
10		Switch 2 (Out)

Connector II



1	+	Inject Start (In)
2	–	Inject Start (In)
3		Ground
4	+	Event (In)
5	–	Event (In)
6	+	Switch 3 (Out)
7	–	Switch 3 (Out)
8		Ground
9	+	Switch 4 (Out)
10	–	Switch 4 (Out)

Signal connections

Detector analog-out/event-in connections

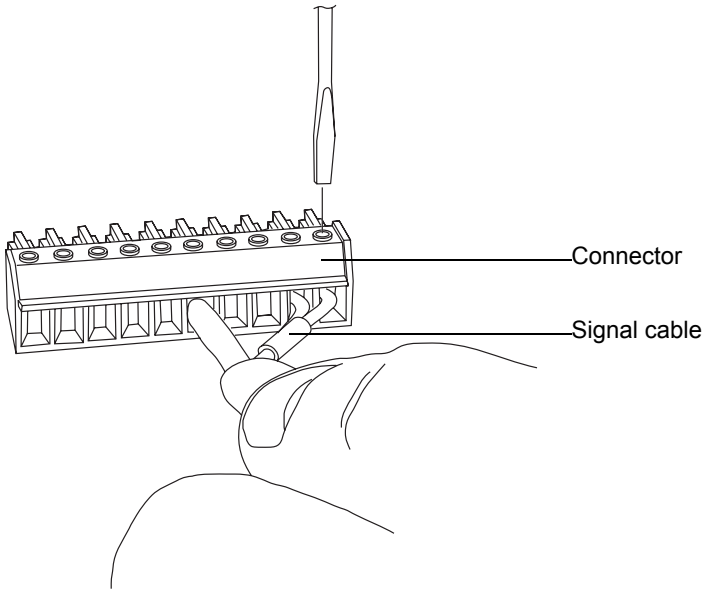
Signal connections	Description
Analog (Out)	Used for analog chart output functionality. The output voltage range is 0 to 2 V. The resolution of the voltage output is 12 bits.
Stop Flow (Out)	Used to stop the solvent flow if the nitrogen gas supply fails. Maximum 30 V, 0.5 A, 10 W.
Inject Start (In)	Signals the start of an injection. Maximum 30 V.
Event (In)	Allows an external device to start data acquisition. Maximum 30 V.
Switch 2 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.
Switch 3 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.
Switch 4 (Out)	Used to send time-based contact closure signals to external devices. Maximum 30 V, 0.5 A, 10 W.

Requirement: To meet the regulatory requirements of immunity from external electrical disturbances, you must install connection covers over the signal connectors.

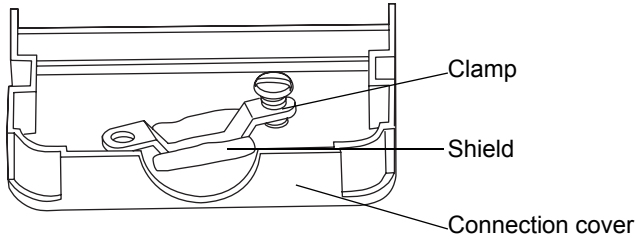
To make signal connections

1. Reference the signal connection location from the silk-screened label for inject start or any other input/output connection you plan to use from Connector I or II on the rear panel of each instrument.

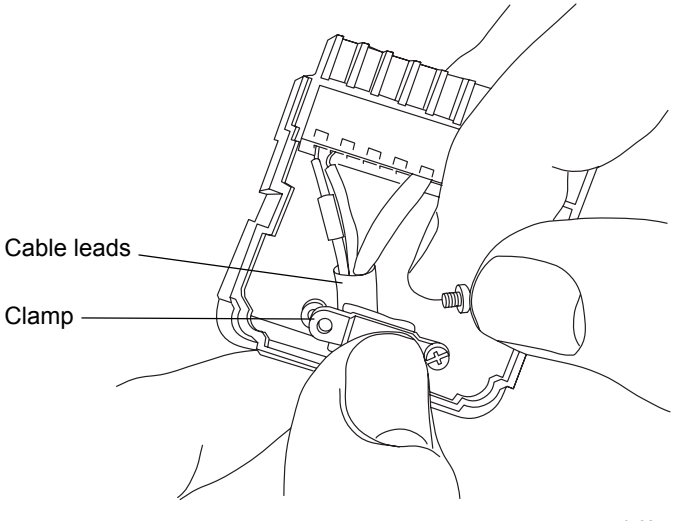
2. To make the signal connections, attach the positive and negative leads of the signal cable to the connector.



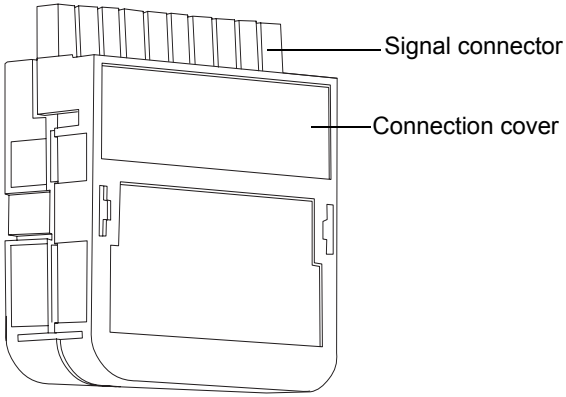
3. Slide the clamp (with the bend facing down) into the protective shield.
4. Insert the clamp and shield (with the bend facing down) into the connection cover, and loosely tighten with one self-tapping screw.



5. Insert the connector with the signal cable into the connection cover, and position the clamp over the cable leads. Tighten the clamp into place with the second self-tapping screw.



6. Place the second connection cover over the first cover, and snap it into place.



Connecting to the electricity source

The detector requires a separate, grounded electricity source. The ground connection in the electrical outlet must be common and connected near the system.

To connect to the electricity source

Recommendation: Use a line conditioner or an uninterruptible power supply (UPS) for optimum long-term input voltage stability.

Warning: To avoid electrical shock, use the SVT-type power cord in the United States and HAR-type (or better) in Europe. For information regarding what cord to use in other countries, contact your local Waters distributor.

1. Connect the female end of the power cord to the receptacle on the rear panel of the detector.
2. Connect the male end of the detector power cord to a suitable 200 to 240 V a.c. wall outlet.
3. Connect the power cord from the roughing pump relay box to a 200 to 240 V a.c. wall outlet.

   The system software controls electrical power to the pump.

C Materials of Construction and Compliant Solvents

Warning: To confirm the integrity of the source exhaust system, you must address any safety issues raised by the contents of this Appendix.

Contents

Preventing contamination

For information on preventing contamination, refer to *Controlling Contamination in LC/MS Systems* (part number 715001307). You can find this document on http://www.waters.com; click Services and Support and then Support Center.

Items exposed to solvent

The items that appear in the following table can be exposed to solvent. You must evaluate the safety issues if the solvents used in your application differ from the solvents normally used with these items. See "Solvents used to prepare mobile phases" on page C-3 for details about the most common ingredients used to prepare mobile phases.

Items exposed to solvent

Item	Material
Autotune reservoirs	High-density polyethylene
Corona discharge pin mounting contact	PEEK™
Gas exhaust port	Aluminium
Gas tubes	Fluorinated ethylene propylene
Ion block	Stainless steel
Ion block support	PEEK
Isolation valve	Gold-plated aluminium/bronze
O-rings	Viton® or PTFE-encapsulated Viton
Probe adjuster bellows	PTFE/Viton
Probe adjuster assembly	Anodized aluminium, glass filled acetal, and stainless steel
Probe shaft	PEEK
Push-in gas fittings	Nickel/brass
Solvent waste/leak management	Tygon tubing
Source enclosure	Alochromed aluminium
Source enclosure view port	Toughened plate glass

Items exposed to solvent

Item	Material
Trap bottle	Polypropylene
Trap bottle push-in fittings	Nitrile butadiene rubber, stainless steel, polybutylene terephthalate, and polyoxymethylene

Solvents used to prepare mobile phases

These solvents are the most common ingredients used to prepare mobile phases for reverse-phase LC/MS (API):

- Water
- Methanol
- Acetonitrile
- Formic acid (<0.1%)
- Acetic acid (<0.1%)
- Trifluoroacetic acid (<0.1%)
- Ammonium acetate (<10 mM)
- Ammonium formate (<10 mM)

These solvents are not expected to cause any problems with the materials identified in “Items exposed to solvent” on page C-2.

D Preparing Samples for LC/MS System Check with Empower software

This appendix describes the procedure for preparing a sulfadimethoxine standard for use with the LC/MS System Check projects supplied for Empower software.

Contents:

Assembling required materials

You must assemble the following materials before starting to prepare your sample:

- Solution kit containing 1 mg/mL sulfadimethoxine stock in methanol. This solution kit is provided with your detector.
- 1 L of solvent made up of 90:10 water/acetonitrile plus 0.1% formic acid (v/v).
- Clean class A volumetric flasks: 100-mL (2), 10-mL.
- Clean class A pipettes (TD), 1-mL (3).
- PTFE-sealed screw-top amber sample bottles (glass or Nalgene™): 125-mL (2), 15-mL (2).
- Sample vial, 2-mL.

Preparing the sulfadimethoxine standard

The target mass of sulfadimethoxine on the HPLC column is 100 pg. Because the supplied LC/MS System Check methods specify an injection volume of 10 µL, you must prepare a 10 pg/µL sulfadimethoxine solution.

To dilute the stock solutions to the final standard concentration:

1. Pour 1 mL of the stock solution into one of the 100-mL volumetric flasks.
2. Dilute to the 100 mL mark with solvent.

   Result: The flask contains a 10 ng/µL sulfadimethoxine solution.
3. Into a second 100-mL volumetric flask, pour 1 mL of the solution created in step 2.
4. Dilute to the 100 mL mark with solvent.

   Result: The flask contains a 100 pg/µL sulfadimethoxine solution.
5. Into the 10-mL volumetric flask, pour 1 mL of the solution created in step 4.
6. Dilute to the 10 mL mark with solvent.

   Result: The flask contains the 10 pg/µL sulfadimethoxine standard solution.

Storing the solutions

Store each of the solutions in an appropriate container. Waters recommends using the following sample bottles:

- For the stock solution, a 15-mL sample bottle.
- For the 10 ng/µL solution, a 125-mL sample bottle.
- For the 100 pg/µL solution, a 125-mL sample bottle.
- For the final sulfadimethoxine standard solution, a 15-mL sample bottle.

Using the solution in an LC/MS System Check run

The final sulfadimethoxine standard solution is ready for use in an LC/MS System Check run with the Empower software.

To use the solution in an LC/MS System Check run:

1. Pour 1 mL of the sulfadimethoxine standard solution into the 2-mL sample vial.
2. If you use an Alliance HPLC system, place the vial in position 1. If you use an Alliance High Throughput System, place the vial in position 1:A,1 of a 48-vial tray.
3. Run LC/MS System Check, as described in the detector's online Help.

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